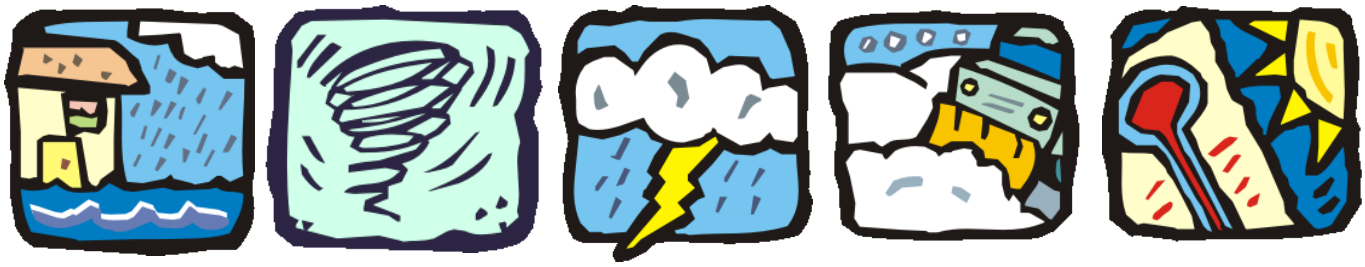

All Hazards Mitigation Plan
St. Croix County, Wisconsin

West Central Wisconsin
Regional Planning Commission

ST. CROIX COUNTY
ALL HAZARDS MITIGATION PLAN

PREPARED BY:

St. Croix County Emergency Government & Communications Committee,
Participating Jurisdictions,
and
St. Croix County Emergency Management

WITH ASSISTANCE BY:

West Central Wisconsin Regional Planning Commission

ADOPTED BY ST. CROIX COUNTY BOARD OF SUPERVISORS
DECEMBER 18, 2007

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SECTION I.

INTRODUCTION

A. PURPOSE OF THE PLAN

The *St. Croix County All Hazards Mitigation Plan* has been prepared as a result of the County's application for, and award of, Pre-Disaster Mitigation (PDM) Grant Program funds. These funds are disbursed by the Federal Emergency Management Agency (FEMA) through Wisconsin Emergency Management (WEM).

The primary focus of the Plan is to evaluate the community's potential exposure to disasters and identify appropriate mitigation strategies. Though the Code of Federal Regulations (see right) focuses such efforts on natural hazards, the County selected to include some man-made hazards within the plan scope as well. Regardless of this expanded scope, this Plan conforms with current applicable Federal requirements for multiple hazards and flood mitigation planning as defined in Sections 201 and 203 of the Stafford Act and in the Flood Mitigation Assistance (FMA) Program as revised by the Federal Disaster Mitigation Act of 2000.

> The Code of Federal Regulations states...
>
> "The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards."
>
> (44 CFR Part 201.6, pp 8851)

Development of the Plan will help the County locate its areas of risk, assess the magnitude of the risk, and develop strategies for reducing the risk. Through this process, the County can address issues related to incompatible land uses, the protection of critical services, and the reduction of community and taxpayer costs associated with disaster relief and rescue efforts. Completion and approval of the Plan will also make St. Croix County and participating jurisdictions eligible to apply for future hazard mitigation project funds through the Federal Emergency Management Agency.

B. PLANNING PROCESS

In July 2006, the St. Croix County Board contracted with the West Central Wisconsin Regional Planning Commission to prepare a local all hazards mitigation plan to identify strategies to mitigate the risks and vulnerabilities associated with hazards.

Development of the *St. Croix County All Hazards Mitigation Plan* was based on the planning requirements and guidance provided by the Federal Emergency Management Agency[1] (FEMA) and the Wisconsin Department of Military Affairs, Wisconsin Emergency Management.[2] As

[1] Federal Emergency Management Agency, Hazard Mitigation Planning and Hazard Mitigation Grant Program, 44 CFR Parts 201 and 206 (Washington: Government Printing Office, February 26, 2002) 8844-8854.
[2] Wisconsin Emergency Management, Resource Guide to All Hazards Mitigation Planning in Wisconsin. April 2003.

such, the Plan meets the Federal requirements under the Disaster Mitigation Act of 2000, including those guidelines for flood mitigation planning.

The Plan's scope is inclusive of all St. Croix County and is considered a multi-jurisdictional plan under Federal guidelines, with the exception of the Village of Spring Valley and City of River Falls which participated in the Pierce County all hazards mitigation planning effort and have adopted that plan.

To guide the Plan's development, the County's Emergency Government & Communications Committee agreed to serve as a steering committee for the effort. This five-member Committee consists of representatives of the County Board, with area emergency services providers, law enforcement personnel, and the private sector also typically attending the meetings and providing input. **Table 1** below shows the Committee members and standard mailing list which, in total, served as the Steering Committee during this Plan's development.

TABLE 1. ST. CROIX COUNTY ALL HAZARDS MITIGATION PLAN STEERING COMMITTEE

Name	Representative of:
Chuck Mehls, Chairman	County Board
Julie Speer, Vice Chair	County Board
Denise Gunderson, Secretary	County Board
Clarence Malick	County Board
John M. Borup	County Board
Jack Colvard	St. Croix County Emergency Management
Bob Klanderman	St. Croix County Sheriff's Department
Craig Nelson	Baldwin – Telecom
Chuck Whiting	St. Croix County Administrative Coordinator
Duana Bremer	Salvation Army
Gary Kollman	St. Croix County Communications Center
Jan George	Red Cross
Jim Vanderwyst	New Richmond Fire Department
Doug Briggs	Somerset Police Department
Lois Ristow	Wisconsin Emergency Management – West Central Region
Wendy Kramer	St. Croix County Public Health

In addition to bringing insight on their respective roles, the Committee members are also very knowledgeable of the issues and concerns of the County's residents. The Committee was responsible for overseeing the developm1ent of the Plan, providing input and review of information and potential strategies, and reviewing and approving the draft Plan.

Development of the Plan began in October 2006 and was completed with the County Board's adopting resolution passed on December 18, 2007. A total of eight (8) Steering Committee meetings were held as part of regularly scheduled County Emergency Government and Communication Committee meetings to discuss the Plan's development, identify local hazard issues, and formulate strategy recommendations.

The general stages of Plan development included: (1) initial data collection and development of the community profile; (2) identification and prioritization of hazard risks by the Steering Committee; (3) community vulnerability and risk assessment; (4) development of the mitigation plan (goals, objectives, strategies, & action plan); and (5) development of the plan maintenance and coordination strategy. This process is shown in **Figure 1** at the end of this section.

The mapping work as part of the community profile (**Section II**) and assessment of hazard conditions (**Section III**) was performed using the ArcView Geographic Information System, allowing greater manipulation and analysis from the use of a consistent base map. The FEMA HAZUS tool was utilized during the identification of critical facilities, but was of limited use during the actual analysis due to the availability of more current and robust local data. Maps included in this Plan are for general planning purposes only and do not constitute legal documents or formal surveys. The flood assessment methodology is detailed in **Appendix B**.

With consideration of National Weather Service historical data and a brief review of other readily available data, the Steering Committee completed a hazards risk and vulnerabilities survey and agreed upon the following hazards to be the focus of this Plan: tornadoes/high winds, winter storms/extreme cold, pandemic flu, hazardous materials incidents, thunderstorms, extreme heat/drought, flooding and nuclear accidents.

A series of key stakeholder interviews, including both public and private sectors, was performed by West Central Wisconsin Regional Planning Commission (WCWRPC) staff to further complement the issue and strategy identification process. These interviews, listed in **Appendix C**, included discussions with emergency management personnel from the adjacent jurisdictions in Wisconsin and Minnesota. Additional input was received from local town, village, and city governments as described within **Section I.C** below.

With guidance provided by these interviews, meetings, and previously described planning steps, the Steering Committee developed the mitigation goals, considered alternative strategies, and developed the action plan. On December 18, 2007, the County Board considered and adopted the *St. Croix County All Hazards Mitigation Plan* at a duly called and noticed public meeting. A copy of the adopting resolution and related meeting minutes are included in **Appendix A**.

C. MULTI-JURISDICTIONAL PLANNING APPROACH

The *St. Croix County All Hazards Mitigation Plan* is a multi-jurisdictional plan and encompasses all incorporated and unincorporated jurisdictions within St. Croix County which have not previously adopted such a plan. All jurisdictions in the County were actively involved in the planning process through the following means:

- The Steering Committee included representation from different areas in the County and numerous organizations.
- A presentation on the planning effort was made to the St. Croix County Towns Association. A risk assessment survey was then mailed to each Town to identify hazards and potential mitigation strategies. Later in the process, draft strategies were sent to each town board for further comment.
- A presentation was made to each participating village and city on the planning effort, and input was obtained on issues or potential strategies. Unique hazard-related issues or strategies for each community were identified.

- Additional follow-up contacts were made with local jurisdictions as needed.

The following jurisdictions adopted this Plan via resolution:

Jurisdiction	*Adoption Date*
St. Croix County (encompasses all unincorporated areas)	12/18/07
Village of Baldwin	04/09/08
Village of Deer Park	03/03/08
Village of Hammond	04/15/08
Village of North Hudson	03/25/08
Village of Roberts	04/14/08
Village of Somerset	02/26/08
Village of Star Prairie	03/05/08
Village of Wilson	04/08/08
Village of Woodville	03/11/08
City of Glenwood City	06/02/08
City of Hudson	04/07/08
City of New Richmond	03/10/08

Adopting resolutions for all of the above jurisdictions are in **Appendix A**.

While partially located in St. Croix County, the Village of Spring Valley and the City of River Falls are largely located in Pierce County. As such, hazard risks, vulnerabilities, and mitigation strategies pertaining to these two communities are discussed in the *Pierce County All Hazards Mitigation Plan* and are not detailed in this document. However, both of these communities were interviewed during the St. Croix County planning process.

D. COMMUNITY INVOLVEMENT

The planning process included the following activities to encourage community input:

- **Steering Committee Meetings.** The eight (8) Steering Committee meetings were properly noticed and open to the public.
- **Key Stakeholder Interviews.** The key stakeholder interviews obtained input from many local public and private stakeholders who are also community members.
- **Local Government Meetings.** The meetings with the Towns Association, Steering Committee, and County Board were all open to the public. Each Town Board received a survey to identify issues and strategies. Meetings were held with each participating incorporated municipality to discuss issues and identify strategies. All Towns and participating municipalities were sent draft strategies for comment.
- **Public Information and Plan Review Meeting**. On August 22, 2007, a public informational meeting was held to allow the public the opportunity to review and comment on the proposed Plan. Advertisement of this meeting included a notice in the official County newspaper and posting in the standard places per County procedures and in accordance with State of Wisconsin law. A copy of the meeting notice is included in **Appendix D**.
- **Plan Adoption.** Following conditional approval of the Plan by Wisconsin Emergency Management, this Plan was adopted by the St. Croix County Board, three cities, and nine villages. All of these meetings were duly called and noticed public meetings.

FIGURE 1. St. Croix County All Hazards Mitigation Planning Process Diagram

Plan Initiation
scope: local decision to proceed, contract w/ WCWRPC, consensus on process, organize steering committee
County roles: mandate to proceed, establish steering committee
RPC roles: facilitate process
Cmte roles: initial introductory meeting on all hazards mitigation planning

Community Profiling
scope: data-collection phase (inventory, stats, uses, trends)
local roles: assist w/ data collection, including existing plans
RPC roles: data collection, analysis, & compilation
Cmte roles: review findings
other issues: identification of critical facilities

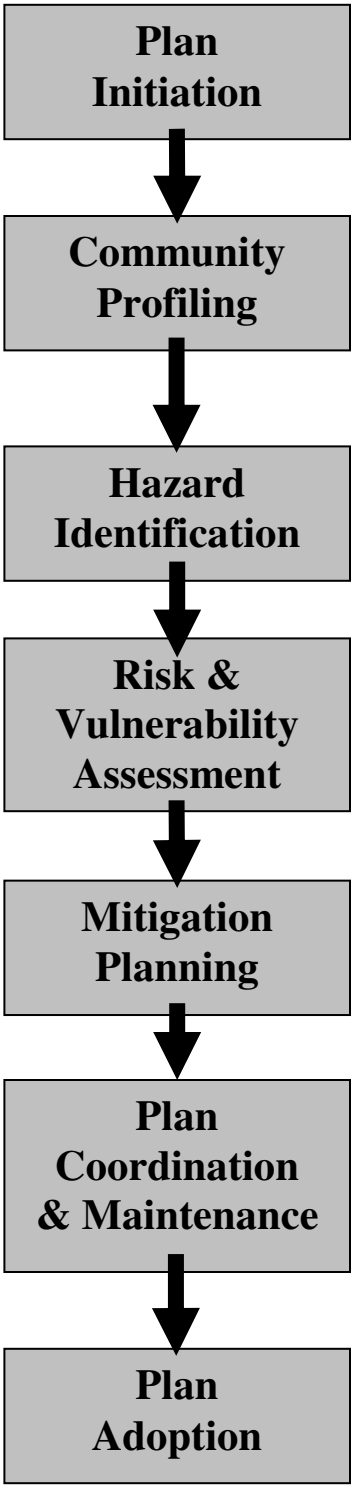
Hazard Identification
scope: identify key hazards
local roles: assist w/ data collection (historical records on events)
RPC roles: data collection (w/ NOAA data) & facilitation
Cmte roles: identify & prioritize key hazards (survey matrix)

Risk & Vulnerability Assessment
scope: identify risks (full history & trends), and vulnerabilities (estimate potential losses to assets)
local roles: identify current mitigation activities
RPC roles: data collection, analysis, & facilitation
Cmte roles: review findings & additional input

Mitigation Planning
scope: goals, objectives, strategies, & action plan
local roles: coordinate meetings & guidance on strategies
RPC roles: facilitation, analysis & guidance on strategies
Cmte roles: goal-setting, propose & review strategies
other issues: feasibility analysis of strategies

Plan Coordination & Maintenance
scope: relationship to other plans & future plan review/updates
local roles: help identify links to other plans; vision for reviews
RPC roles: facilitation & suggestions
Cmte roles: review & modify/amend recommendations
other issues: integrate required 5-year updates

Plan Adoption
scope: Cmte review-> Other review-> public info. mtg.-> State pre-review & conditional approval -> local adoption-> formal State & FEMA approval
local roles: facilitate public hearings, notifications, comments, etc
RPC roles: assist w/ public hearings & modifications to plan
Cmte roles: consider public input & approve draft plan
other issues: special mailings to communities; media



SECTION II.

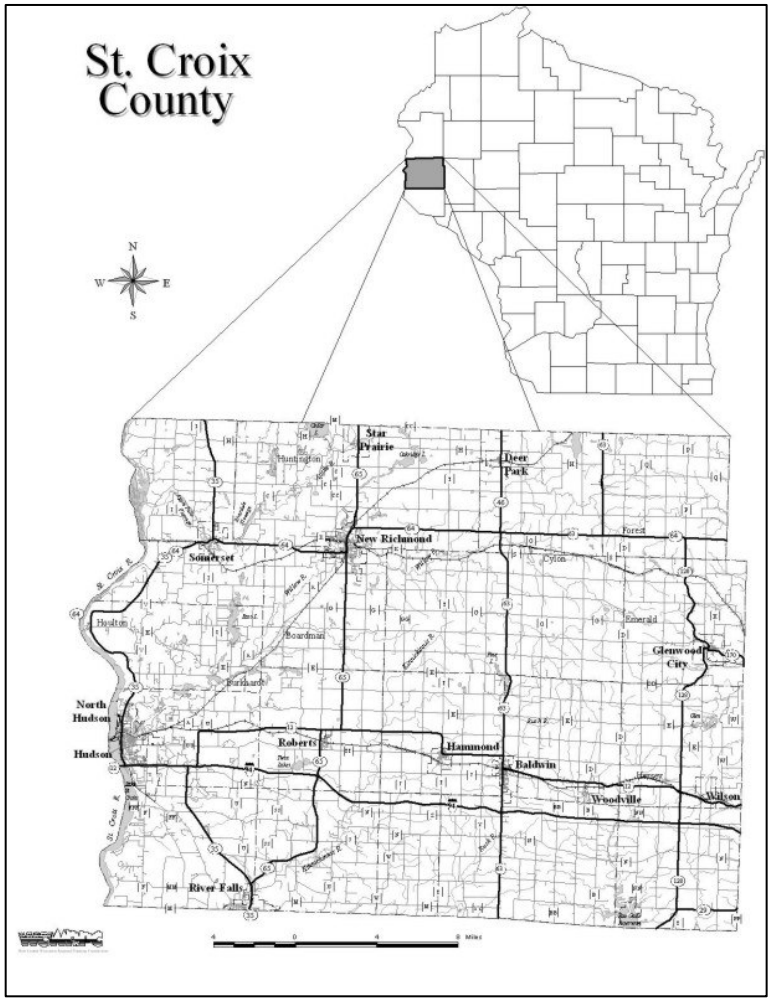
COMMUNITY PROFILE – ST. CROIX COUNTY

The community profile section of the Plan is intended to provide background data and analysis in order to better understand the natural and man-made characteristics of the community. Included in this section is a description of the natural and demographic characteristics, general development trends, and an inventory of critical facilities.

A. GEOGRAPHIC LOCATION

St. Croix County is located in west-central Wisconsin (see **Figure 2**) , and is separated from the State of Minnesota by the St. Croix River. The County has a total of 469,760 acres, or 736 square miles, of land, measuring approximately 25 miles north-to-south and 35 miles east-to-west. The County is bordered to the north by Polk County, to east by Dunn County, to the west by Washington County (MN), and to the south by Pierce County.

FIGURE 2.
St. Croix County Geographical Location

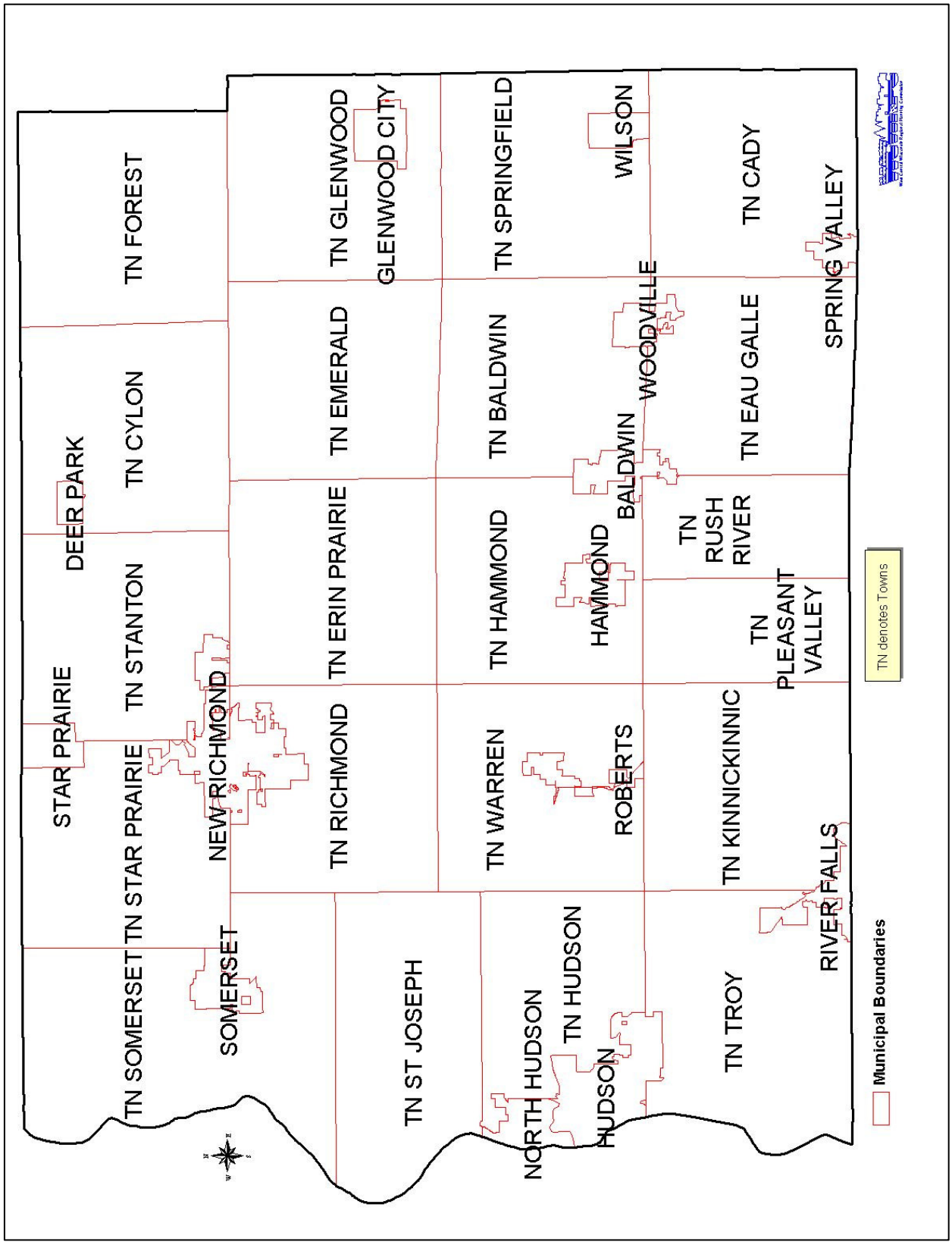


The County is made up of 35 minor civil divisions, which include 21 towns, 10 villages, and 4 cities as shown in **Figure 3** on the following page. The largest portions of the City of River Falls and the Village of Spring Valley lie within Pierce County to the south. The largest city entirely located within St. Croix County—the City of Hudson—is the County seat.

St. Croix County is part of the Minneapolis-St. Paul Metropolitan Statistical Area and was the fastest growing county in Wisconsin during the first half of this decade.

Interstate 94, which bisects St. Croix County, is the primary transportation arterial between Minneapolis-St Paul and cities to the south and east, such as Eau Claire, Green Bay, Madison, Milwaukee, Rockford, and Chicago.

FIGURE 3. St. Croix County Civil Divisions



B. NATURAL FEATURES AND ENVIRONMENT

i. Lakes, Rivers and Streams

The surface waters of St. Croix County fall within two major drainage systems—the St. Croix River Basin and the Lower Chippewa River Basin. Surface waters in the western two-thirds of the County, including the Apple, Kinnickinnic, and Willow Rivers, fall within the St. Croix River Basin. The eastern third of the County, including the Hay and Eau Galle Rivers, are part of the Lower Chippewa River Basin. The exception is the Rush River in the south-central part of the County which flows directly into the Mississippi River.

The lakes of St. Croix County, with the St. Croix River included, have a total surface area of approximately 9,598 acres or 15 square miles. The St. Croix River and its man-made lake (Lake St. Croix) is the largest surface water in St. Croix County. Approximately half of the 9,336-acre Lake St. Croix is located on the Wisconsin side of the state border with Minnesota. The St. Croix River is also notable since it has been designated by Congress as the Lower St. Croix National Scenic Riverway. With this designation, the National Park Service works with local jurisdictions to manage and protect this waterway.

At 416 acres, Bass Lake in the Towns of Somerset and St. Joseph is the largest inland surface water entirely within the County, though a considerable portion of the 1,107-acre Cedar Lake in the Town of Star Prairie is also in St. Croix County. Other lakes of considerable size include Little Falls Lake (172 acres), Lake Mallalieu (270 acres), Pine Lake (107 acres), and Squaw Lake (129 acres). A portion of the 150-acre Eau Galle Lake/Lake George is located in the Town of Cady. **Figure 4** on the following page shows the County's surface waters, with names of the larger lakes and rivers identified. Cedar Lake, Bass Lake, Willow River, and St. Croix River in the western half of the County account for about 90% of the County's surface water acreage.

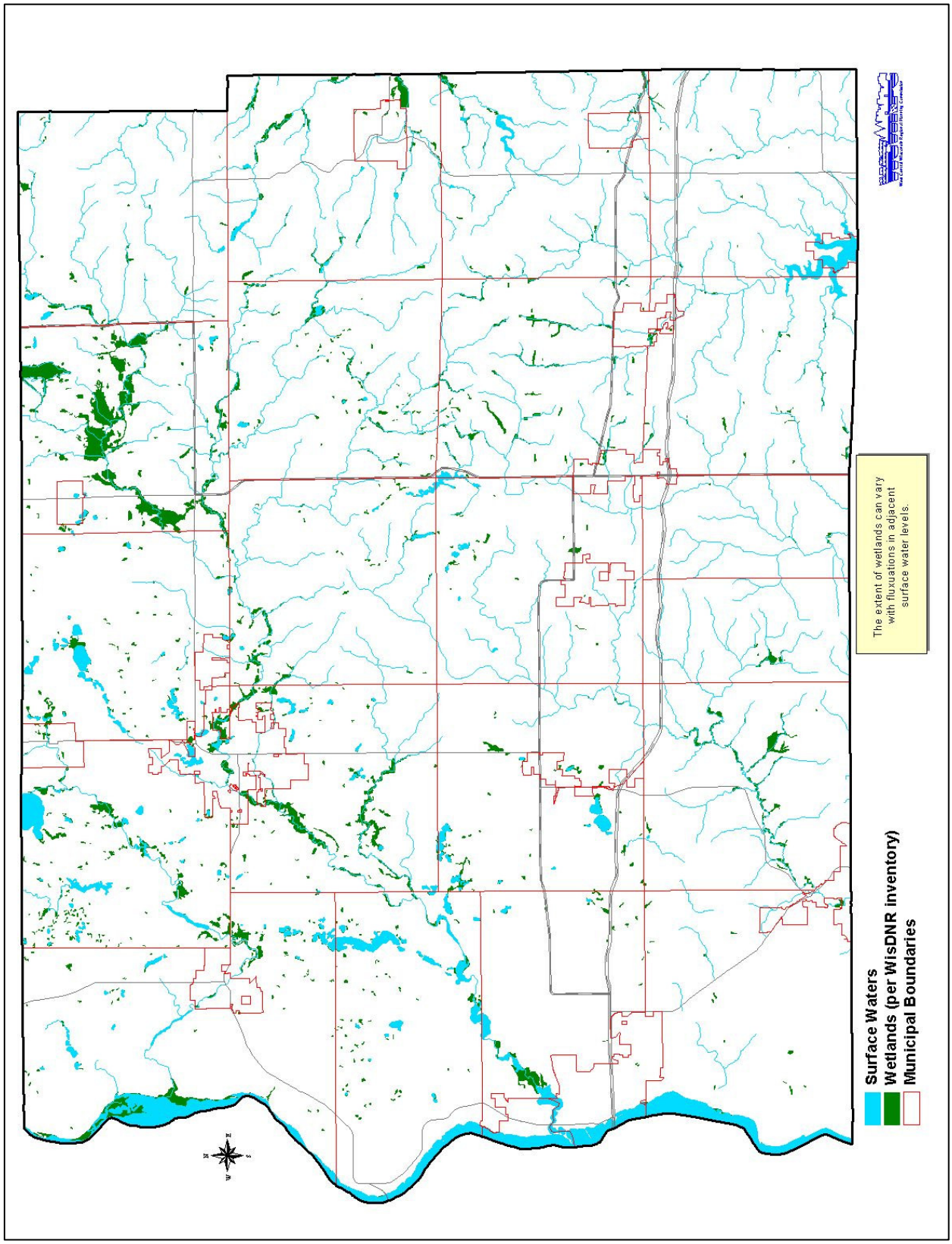
The floodplain and flood hazard areas within the County associated with these water bodies are discussed later within **Section III. Assessment of Hazard Conditions** of this report. Regulatory tools guiding development in floodplain and shoreland areas are discussed in the current mitigation activities sub-section of **Section III**.

ii. Wetlands

Wetlands are defined by State Statute as "an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic (water-loving) vegetation and which has soils indicative of wet conditions." Wetlands may be seasonal or permanent and are commonly referred to as swamps, marshes, or bogs. Wetland plants and soils have the capacity to store and filter pollutants, replenish groundwater supplies, and store floodwaters.

As **Figure 4** on the following page shows, wetlands are most prevalent along the rivers and streams of the county. Large, contiguous areas of wetlands are found along Willow Creek and its tributaries, in particular within the Town of Cylon. Wetlands are also common along portions of the Apple River, Tiffany Creek, and the Kinnickinnic River. A large area of wetlands not entirely shown in Figure 4 are the many small islands and shallow backwaters of the St. Croix River along the western edge of the Town of Somerset. In all, St. Croix County has approximately 14,536 acres of wetlands which are 5 or more acres in size.

FIGURE 4. Surface Waters and Wetlands
St. Croix County



iii. Topography

The topography of St. Croix County ranges from gently rolling to steep ridges along stream valleys (see **Figure 5**). Local relief in the County ranges from almost 1,300 feet in the eastern hill area down to 675 feet in the southwest. About 65% of the soils in St. Croix County are considered nearly level or gently sloping with only about 15% classified as moderately to very steep. Generally, the more rugged topography can be found in southern parts of the County and along the eastern edge, while the central part of the county is a gently undulating plain.

Topography is an important factor in determining flood risks and vulnerabilities. As Figure 5 shows, most surface waters drain to the south and west, toward the St. Croix and Mississippi River, with the exception of far eastern portions of the County, such as the areas surrounding Glenwood City and Wilson, which drain towards Dunn County to the east. Approximately 85% of the County is classified as uplands, which may be less prone to the vulnerabilities associated with large riverine flooding events, but where stormwater or flash flooding may be a more common problem. Stormwater erosion and flash flooding can be a significant concern for those areas with moderate to steep topography.

While not necessarily a topographic feature, closed depressions are common in St. Croix County. Closed depressions and the resulting kettles in the western and northwestern parts of the County were typically formed from the melt of glacial ice within buried glacial deposits. In the eastern parts of the County, closed depressions and the resulting sinkholes are common when limestone bedrock was eroded, which is referred to as karst development. These closed depressions will be discussed later in this report in the context of land subsidence and the increased vulnerability of groundwater contamination in such areas.

iv. General Climate

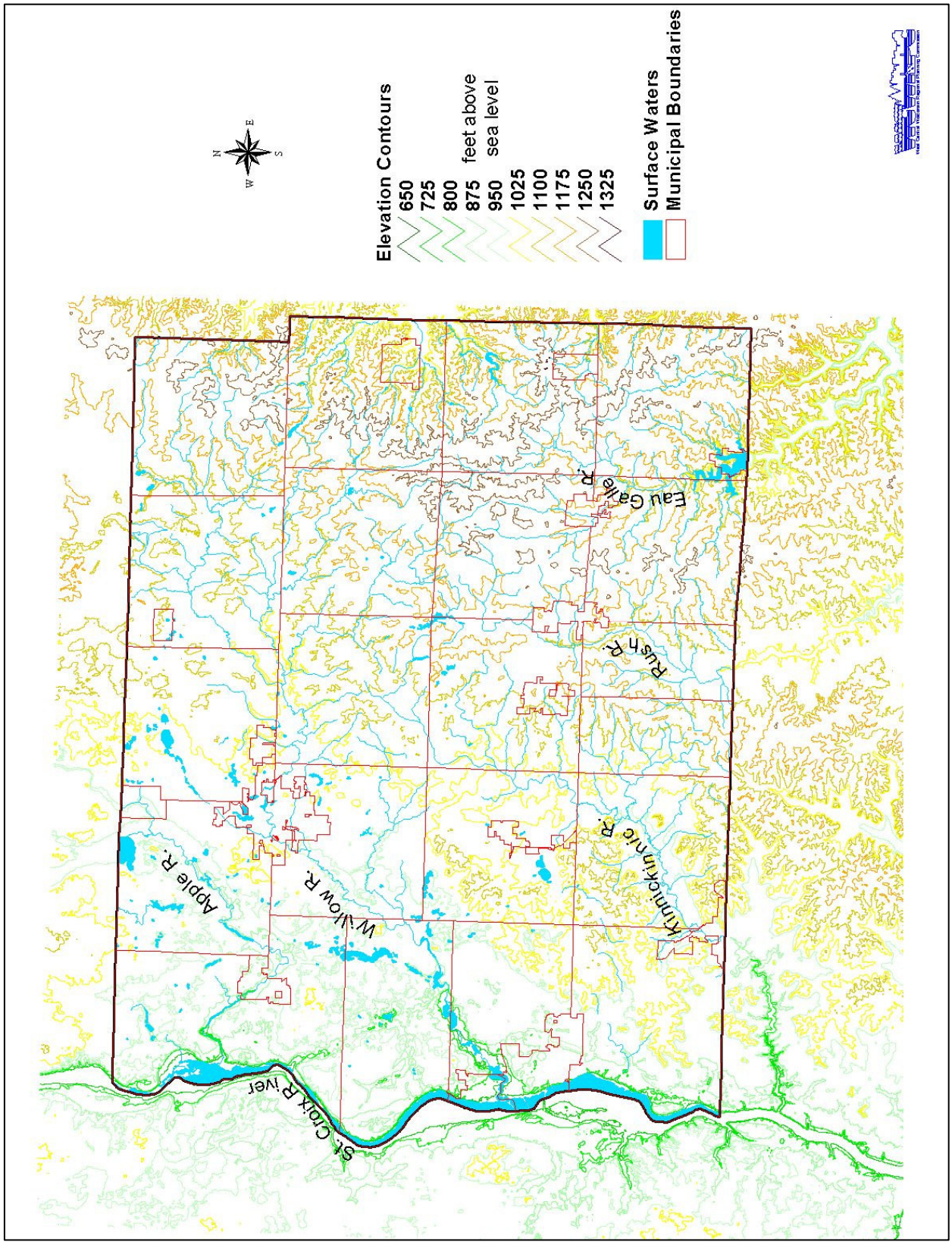
The climate of St. Croix County is classified as mid-latitude continental. Warm, humid summers and cold, snowy winters are the main characteristics. The average daily temperature ranges from a 5-degrees Fahrenheit minimum in January to an 84-degrees Fahrenheit maximum in July.

Annual precipitation averages 32 inches, with approximately 65% occurring as rain between the months of May through September. The heaviest rainfalls occur during the last three weeks of June. About once every two years, a portion of the County experiences 2.5 inches or more of rain in a 24-hour period. The possibility of a 7-day dry period during the summer is greatest in the last part of July.

Thunderstorms occur on an average of 40 days a year, with extremes ranging between 58 thunderstorms in one year down to 23 in another. Only 2 days a year on average experience hail, with an extreme range of 7 days in a year down to none. Seasonal snowfall has ranged from 15 inches in 1931 and 1958 up to 80 inches in 1951.

St. Croix County is susceptible to a range of natural hazards, including flooding. A description of these natural hazards, along with historical trends and current risks, is included in **Section III** of this report.

FIGURE 5. Elevation by 75' Contour Interval
St. Croix County



C. DEMOGRAPHIC AND ECONOMIC PROFILE

i. Population

According to the 2000 Census, the population of St. Croix County was 63,155. The largest community and county seat, the City of Hudson, had a 2000 population of 8,775 residents. Shown in **Table 2** are the 1970 through 2000 Census populations for St. Croix County and its minor civil divisions.

TABLE 2. Historic Population and Population Change • 1970 to 2000
St. Croix County and Minor Civil Divisions

	1970	*1980*	*1990*	*2000*	*1970-80 (%)*	*1980-90 (%)*	*1990-00 (%)*
Towns:							
Baldwin	890	943	911	903	6.0	-3.4	-.9
Cady	670	724	643	710	8.1	-11.2	10.4
Cylon	620	717	639	629	15.7	-10.9	-1.6
Eau Galle	720	897	756	882	24.6	-15.7	16.7
Emerald	588	638	630	691	8.5	-1.3	9.7
Erin Prairie	516	661	647	658	28.1	-2.1	1.7
Forest	649	631	614	590	-2.8	-2.7	-3.9
Glenwood	764	715	700	755	-6.4	-2.1	7.9
Hammond	764	822	819	947	7.6	-.4	15.6
Hudson	925	2,012	3,692	6,213	117.6	83.5	68.3
Kinnickinnic	755	1,051	1,139	1,400	39.2	8.4	22.9
Pleasant Valley	330	360	384	430	9.1	6.7	12.0
Richmond	1,091	1,338	1,400	1,556	22.6	4.6	11.1
Rush River	439	476	419	498	8.4	-12.0	18.9
St. Joseph	1,357	2,180	2,657	3,436	60.7	21.9	29.3
Somerset	1,185	1,833	1,975	2,644	54.7	7.8	33.9
Springfield	811	816	772	808	.6	-5.4	4.7
Stanton	975	1,083	1,042	1,003	11.1	-3.8	-3.7
Star Prairie	1,390	1,900	2,098	2,944	36.7	10.4	40.3
Troy	1,517	2,326	2,850	3,661	53.3	22.5	28.5
Warren	622	897	1,008	1,320	44.2	12.4	31.0
Subtotal:	**17,578**	**23,020**	**25,795**	**32,678**	**31.0**	**12.1**	**26.7**
City/Village:							
Baldwin	1,399	1,620	2,022	2,667	15.8	24.8	31.9
Deer Park	217	232	237	227	6.9	2.2	-4.2
Glenwood City	822	950	1,026	1,183	15.6	8.0	15.3
Hammond	768	991	1,097	1,153	29.0	10.7	5.1
Hudson	5,049	5,434	6,378	8,775	7.6	17.4	37.6
New Richmond	3,707	4,306	5,106	6,310	16.2	18.6	23.6
North Hudson	1,547	2,218	3,101	3,463	43.4	39.8	11.7
River Falls (part)	991	1,498	1,769	2,318	51.1	15.3	31.0
Roberts	484	833	1,043	969	72.1	25.2	-7.1
Somerset	778	860	1,065	1,556	10.5	23.8	46.1
Spring Valley (part)				2	-	-	200.0
Star Prairie	362	420	507	574	16.0	20.7	13.2
Wilson	130	155	163	176	19.2	5.2	8.0
Woodville	522	725	942	1,104	38.9	30.0	17.2
Subtotal:	**16,776**	**20,242**	**24,456**	**30,477**	**20.7**	**20.8**	**24.6**
COUNTY TOTALS:	**34,354**	**43,262**	**50,251**	**63,155**	**25.9**	**16.2**	**25.7**

Source: U.S. Census Bureau

Approximately 52% of St. Croix County's population is located in the unincorporated towns, which is proportionately similar to the distribution in 1970.

Shown in **Table 3** are the 2000 Census population, 2006 Wisconsin Department of Administration's population estimate, and the West Central Wisconsin Regional Planning Commission's projected population for the years 2010 through 2030 in five-year increments.

TABLE 3. Estimated and Projected Population • 2000 to 2030
St. Croix County and Minor Civil Divisions

Municipality	2000 Census	2006 Estimate	2010 Projected	2015 Projected	2020 Projected	2025 Projected	2030 Projected	2000 to 2030 % change
Towns:								
Baldwin	903	969	988	1,012	1,036	1,060	1,083	+20.0%
Cady	710	794	828	871	914	957	1,000	+40.9%
Cylon	629	671	680	692	704	716	728	+15.7%
Eau Galle	882	1,002	1,061	1,134	1,207	1,208	1,353	+53.4%
Emerald	691	789	835	892	949	1,006	1,064	+53.9%
Erin Prairie	658	682	695	712	729	746	762	+15.8%
Forest	590	626	632	632	648	656	664	+12.5%
Glenwood	755	871	917	975	1,033	1,091	1,149	+52.2%
Hammond	947	1,642	2,061	2,586	3,110	3,634	4,158	+339.1%
Hudson	6,213	7,690	10,912	14,940	18,967	22,995	27,022	+334.9%
Kinnickinnic	1,400	1,640	1,821	2,047	2,272	2,498	2,724	+94.6%
Pleasant Valley	430	490	523	565	606	648	690	+60.4%
Richmond	1,556	2,625	3,269	4,073	4,878	5,683	6,488	+316.9%
Rush River	498	530	550	575	599	624	649	+30.3%
St. Joseph	3,436	3,807	4,279	4,868	5,458	6,048	6,637	+93.2%
Somerset	2,644	3,405	4,013	4,774	5,534	6,294	7,054	+166.8%
Springfield	808	921	962	1,012	1,063	1,114	1,165	+44.1%
Stanton	1,003	1,012	1,010	1,008	1,006	1,003	1,001	-0.2%
Star Prairie	2,944	3,568	4,126	4,824	5,521	6,219	6,916	+134.9%
Troy	3,661	4,431	5,131	6,005	6,880	7,754	8,629	+135.7%
Warren	1,320	1,542	1,742	1,993	2,243	2,493	2,744	+107.9
Villages:								
Baldwin	2,667	3,519	4,176	4,997	5,818	6,640	7,461	179.7%
Deer Park	227	222	220	218	215	213	210	-7.3%
Hammond	1,153	1,647	1,911	2,240	2,569	2,899	3,228	+180.0%
North Hudson	3,463	3,691	4,012	4,413	4,814	5,215	5,616	+62.2%
Roberts	969	1,479	1,776	2,147	2,518	2,890	3,261	+236.5%
Somerset	1,556	2,250	2,830	3,555	4,280	5,005	5,729	+268.2%
Star Prairie	574	628	672	727	782	837	892	+55.4%
Spring Valley (part)	2	4	4	4	4	4	4	+100.0%
Wilson	176	201	214	230	247	263	279	+58.6%
Woodville	1,104	1,309	1,477	1,686	1,896	2,106	2,316	+109.7%
Cities:								
Glenwood City	1,183	1,227	1,280	1,347	1,413	1,480	1,546	+30.7%
Hudson	8,775	11,700	13,907	16,666	19,425	22,184	24,943	+184.3%
New Richmond	6,310	7,858	8,938	10,287	11,637	12,987	14,336	+127.2%
River Falls (part)	2,318	2,586	2,898	3,289	3,679	4,070	4,460	+92.4%
TOTALS	**63,155**	**78,028**	**88,953**	**102,610**	**116,267**	**129,924**	**143,581**	**+127.3%**

Sources: 2000 U.S. Census; 2006 WisDOA estimate, WCWRPC projections

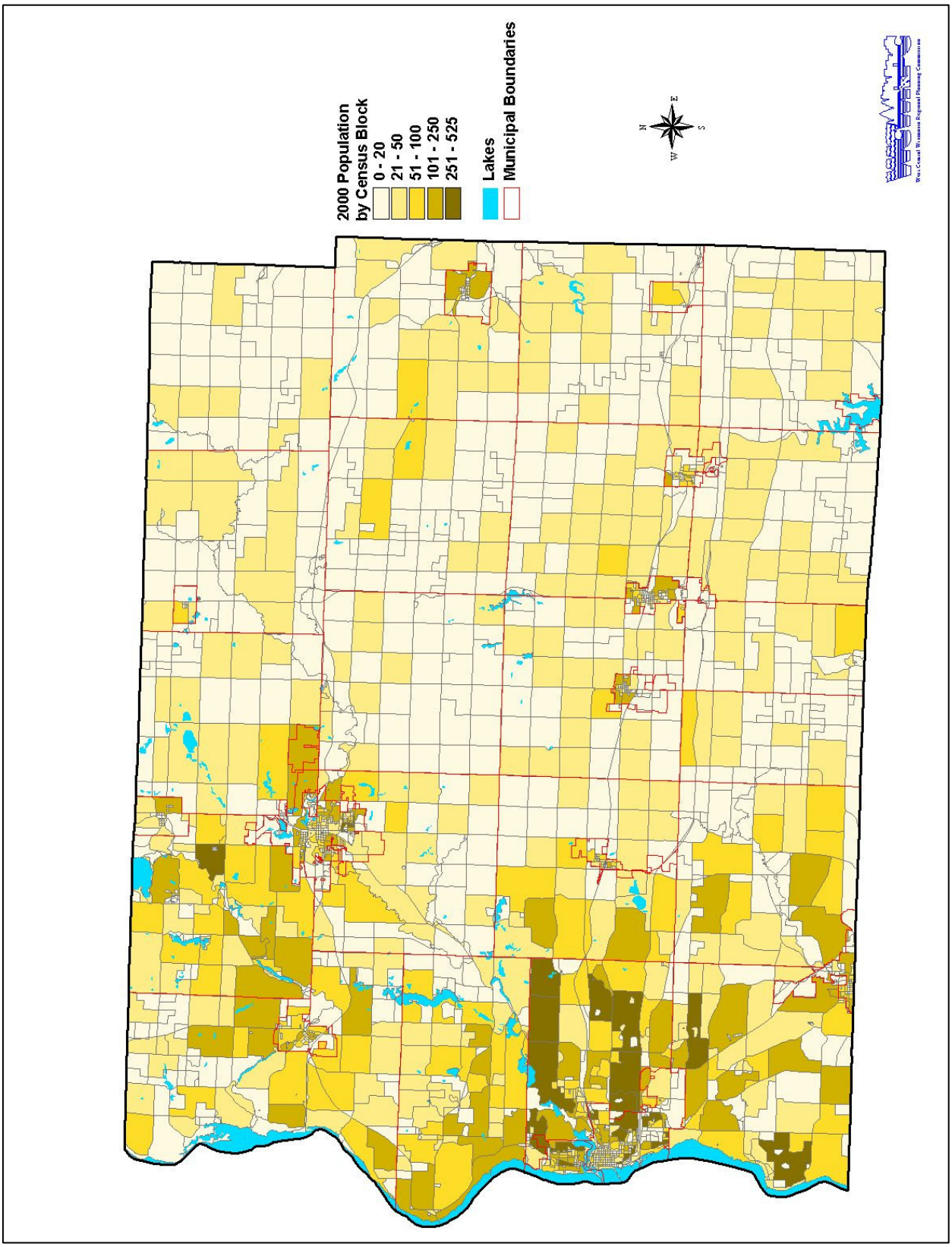
From 2000 to 2004, St. Croix County was the fastest-growing county in Wisconsin and the 72nd fastest-growing county in the United States. Over the next twenty years, the County's population is projected to increase nearly 40% to over 100,000 residents. Remarkably, this would be an increase in total population comparable to the added number of residents during the thirty-year span of 1970 to 2000.

Consistent with population growth since the 1960s, some of the fastest growing communities are projected to be found in the western portions of the County, such as the Town of Hudson, the Village of Somerset, and the City of Hudson. However, population growth farther to the east along the Interstate 94 corridor (e.g., Roberts and Hammond areas) is also projected to significantly increase as well as in the City of New Richmond and areas of the surrounding towns.

The rate of growth in the County has been even greater than the official State of Wisconsin Department of Administration (WisDOA) projections last updated in 2003. The U.S. Census American Community Survey estimates the 2005 St. Croix County population at 76,227 residents, or 3,850 more residents than projected by WisDOA. So, instead of the County's population growing by 14.6% from 2000 to 2005 as originally projected, it grew by 20.7%. Though WisDOA 2005 and 2006 estimates are similar to the results of the American Community Survey, WisDOA has not updated their projections. Instead, the projections in Table 3 were developed by West Central Wisconsin Regional Planning Commission (WCWRPC) using a methodology similar to WisDOA.

Figure 6 on the following page shows the estimated 2000 population distribution within St. Croix County by census block. The map shows that the highest concentrations of County residents are located closest to the Minneapolis-St. Paul area. A comparison of Figure 4 and Figure 6 shows that some of the areas with the highest populations are those with some of the largest surface water features in the County (e.g., St. Croix River).

FIGURE 6. 2000 Estimated Population Distribution by Census Block



ii. Housing

Continued population growth in St. Croix County has created a corresponding demand for additional housing, shown in **Table 4.**

TABLE 4. Housing Unit Change • 1980 to 2000
St. Croix County

Year	Number of Housing Units	Numerical Change	Percent Change
1980	14,710		
1990	18,519	+3,809	+25.9%
2000	24,265	+5,746	+31.0%
2005	31,140	+6,875	+28.3%

Source: 1980, 1990, & 2000 Census; 2005 American Community Survey

More housing units in St. Croix County were added from 2000 to 2005 than in all of the previous decade (1990 to 2000). In 2005, approximately 94% of all housing units were occupied by an average of 2.60 persons per occupied unit.[3] Using a simple housing unit projection methodology, it is possible to estimate of the number of additional housing units that will be required to meet the projected population change, assuming 2.60 persons per unit and current occupancy rates. Shown in **Table 5**, are the housing unit projections for St. Croix County for the years 2000 through 2025.

TABLE 5. Housing Unit Forecast • 2000 to 2025
St. Croix County

	2000 *Census*	2005 *Estimate*	2010 *Projection*	2015 *Projection*	2020 *Projection*	2025 *Projection*
Population	63,155	76,227	88,953	102,610	116,267	129,924
Housing Units	24,265	31,140	36,421	42,191	47,807	53,423
Housing Unit Change		+6,875	+5,281	+5,770	+5,616	+5,616

Source: 2000 Census; 2005 American Community Survey; WCWRPC projections

Of interest, 94.3% of all housing units in St. Croix County in 2005 were owner-occupied (not rented), compared to the State of Wisconsin average of 68.4%. In 2000, approximately 27.3% of the County's housing units were multi-unit or attached structures (e.g., duplexes, apartments), which is comparable to the State-wide average of 26.2%, with 52% of the County's multi-unit structures located within the City of Hudson, City of River Falls, and Village of North Hudson. However, during the planning process, numerous communities noted that slab-on-grade duplex construction was a popular form of new home construction. Combined with general population growth, the number and percentage of multi-unit housing structures in the County will likely increase in the future.

According to the 2000 Census, a total of 1,131 housing units (4.7% of all units) in St. Croix County were mobile homes, very comparable to the State of Wisconsin average of 4.4%. The majority of these mobile homes (or 57%) were located in unincorporated towns. Approximately 14.6% (or 165) of these mobile homes in 2000 were located within the Town of Star Prairie, and

[3] Average per occupancy based on 2005 American Community Survey total housing unit and population estimates. For comparison, in 2000, the average household size was 2.67 persons per occupied housing unit.

Mobile Home Park in the Village of Roberts

12.8% (or 145) were located in the Village of Roberts, constituting 36% of its total housing stock. The average of 2.36 persons per occupied mobile home housing unit in 2000 was slightly lower than the overall average for all housing units in the County.

A number of communities in the western portions of the County noted that high land prices discourage the installation of new mobile homes. No housing units in St. Croix County were identified as being boats, RVs, vans, etc. Approximately 15% of the County's housing units were built in 1939 or earlier, with 44% of the housing units being built since 1990. The number of mobile homes by municipality in 2000 is shown later in Table 9. Initial reports from the 2005 American Community Survey is that there has been significant increases in the number of mobile homes in the County between 2000 and 2005, but the estimated increase is still within the very large margin of error, so this data may not be a reliable estimate.

In 2000, St. Croix County had only 281 seasonal or recreational housing units, which is relatively low compared to some other counties in the region. Almost 40% of these seasonal units were located in the Town and Village of Star Prairie, with an additional 16% of these units located in the Town of St. Joseph. Notably, 27.5% of all housing units in the Village of Star Prairie were reported as being for seasonal or recreational use in 2000.

iii. Economic Overview

The economy is an important determining factor driving land use and development. With its population growth, St. Croix County is also experiencing shifts in its economy with substantial employment increases in the finance, education, and trade/transportation sectors, and decreases in the agricultural sector over the last few decades. And with approximately 37% of all employed persons in St. Croix County commuting to the Minnesota counties of Washington, Ramsey, or Hennepin, the economic influences of the Minneapolis/St. Paul urban area on St. Croix County are enormous. **Table 6** shows the 2005 employment by industry for jobs provided in St. Croix County.

TABLE 6. Employment By Industry – 2005
St. Croix County

Industry Category	*2005 employment*
Agriculture (derived from 2000 Census)	1,093
Goods Producing	
Construction, Natural Resources, & Mining	2,088
Manufacturing	5,723
Service Producing	
Trade, Transportation, & Utilities	5,766
Finance, Insurance & Real Estate	1,185
Education & Health Services	4,716
Leisure & Hospitality Services	3,425
Professional & Business Services	1,960
Other Services (includes information services)	1,013
Public Administration	1,261
Total	28,230

Source: Wisconsin Department of Workforce Development
Note: Employment represents the number of jobs provided by employers in the County and not the number of employed individuals in the County.

As of 2005, none of largest manufacturers in St. Croix County had over 500 employees. Most of the largest manufacturers are located in one of the nine industrial parks located throughout the County. Employment in the services sector is high due in large part to the existence of the numerous schools and the Wisconsin Indianhead Technical College.

According to the Wisconsin Department of Workforce Development, the 2004 median household income in St. Croix County was $47,713, significantly higher than the Wisconsin average of $38,991 in 2004. However, per capita property taxes and housing values also tend to be higher than State of Wisconsin averages, influencing land-use and development patterns.

iv. Property Values

According to the Wisconsin Department of Revenue, the aggregated assessed value for the St. Croix County in 2005 was over $6.5 billion.[4] **Table 7** at the right summarizes the 2005 Statement of Assessments for the County.

TABLE 7. St. Croix County 2005 Assessed Total Values

Land	$1,851,035,115
Improvements	$4,565,614,482
Real Estate	$6,416,649,597
Personal Prty	$ 86,338,598
Aggregate	$6,502,988,195

From 2003 to 2005, the County's total assessed value grew by over $1.5 billion (a 31% increase), demonstrating that significant growth and development are occurring in the County. **Table 8** further breaks down the 2005 aggregated assessed values by primary land uses:

[4] Wisconsin Department of Revenue, Bureau of Equalization. 2005 Statement of Assessments, Unequalized assessed values used to best represent that actual value of improvements.

TABLE 8. Assessed Value by Land Use • 2005
St. Croix County

	Land Value	Improvements	Total
Residential	$1,447,196,255	$3,798,878,900	$5,246,075,155
Commercial	$180,657,900	$513,843,632	$694,501,532
Manufacturing	$15,928,400	$107,180,400	$123,108,800
Agricultural	$35,442,850	$0	$35,442,850
Undeveloped	$40,635,850	$0	$40,635,850
Agri. Forest	$36,233,810	$0	$36,233,810
Forest	$73,750,000	$0	$73,750,000
Other	$21,190,050	$145,711,550	$166,901,600
Totals	$1,851,035,115	$4,565,614,482	$6,416,649,597

source: Wisconsin Department of Revenue. 2005 Statement of Assessments.

During the planning process and interviews with some communities, it was stated that high land values in some municipalities in western portions of the County are impacting the type of development which is occurring. In areas of high land values, mobile home development is much less likely, while duplex development is becoming more common. For comparison, the average assessed value for a parcel of residential land in the Town of Troy was $95,645 in 2005 compared to an average value of $17,436 per parcel in the Town of Forest.

A comparison of the aggregate assessed values in 2005 for St. Croix County and Dunn County, its neighbor to the east, further illustrates the population growth, development, and high land values occurring in portions of St. Croix County. Even though St. Croix County has almost 18% (or 82,662) fewer land acres than Dunn County, it had over three times the total aggregate assessed value of Dunn County in 2005.

D. GENERAL DEVELOPMENT PATTERN

The current land use in St. Croix County is historically linked to the use of the region's rivers and streams, as well as railroads, for transportation during its initial settlement. Early development primarily revolved around the fur trade and lumber industry, with villages and cities originally most often forming near the sites of sawmills and the rivers used for the transportation of furs and cut timber. Prior to the formation of the Minnesota territory in 1849, Hudson appeared on the verge of outstripping Minneapolis/St. Paul as a regional center of commerce due to Hudson's better river navigation at that time. In time, rail systems were developed which connected many of the villages and small hamlets in the County, improving the movement of goods and people for those communities which did not have river access.

During the late 1880s and 1890s, as the lumber boom subsided, agriculture began to increase in importance. Immigrants and settlers began to acquire property in cut-over areas and made productive use of the fertile soils. By 1900, agriculture was the basic industry of St. Croix County, with most cities and villages becoming farm trade centers with creameries, flour mills, and other related services. The tourist trade in St. Croix County also began to grow in the late 19th and early 20th Centuries, as small resorts began to be developed along lakeshores for boating, fishing, and related recreation. This trend of shoreland development for recreational or seasonal use would continue until today.

In the last half of the 20th Century, agriculture began to decline as the primary economic activity in the County, while employment in manufacturing, services, retail trade, and commuter traffic to jobs outside the County increased. Concurrently, recreational use of the County's natural resources has continued to increase, offering both residents and visitors access to recreational trails, hunting lands, and surface waters for fishing, boating, and canoeing. And, based on anecdotal evidence, many of the shoreland homes once used as seasonal vacation cottages have now been remodeled, expanded, or replaced for year-round, permanent residence.

Non-farm residential development has increased considerably, especially in those areas of the County closest to the St. Croix River and the Twin Cities, as reflected in the previously discussed population and housing trends. Slowly, the function of many of the villages has also begun to change from services oriented to the agricultural community towards other generalized services. This increasingly service-oriented economy is driven in large part by the growing number of St. Croix County residents who commute to Minnesota for employment.

While agricultural acreage decreased by almost 30,000 acres in St. Croix County between 1973 and 1993, over 68% of the assessed acreage in 2006 was agricultural and agricultural buildings. Forest and undeveloped lands constitute an additional 16% of all assessed acreage. The current assessed land uses by acreage and community are provided in Table 9.

TABLE 9. Acreage by Assessed Land Use -- 2006
St. Croix County and Municipalities

Type and Name of Municipality	2006 Assessed Acreage								# of mobile homes
	Resid.	Comm.	Manuf.	Agri.	Ag. Bldgs	Forest	Undevel.	Total	
T BALDWIN	851	115	0	14,166	232	578	2,798	18,740	8
T CADY	596	46	53	14,048	171	962	1,972	17,849	38
T CYLON	723	46	59	11,853	141	1,675	2,115	16,611	10
T EAU GALLE	1,125	24	0	11,471	162	1,880	2,040	16,701	11
T EMERALD	668	18	45	15,674	259	1,483	1,307	19,455	15
T ERIN PRAIRIE	733	6	0	16,623	143	670	1,439	19,614	7
T FOREST	390	29	0	15,049	197	2,483	1,389	19,536	14
T GLENWOOD	596	5	0	14,060	181	764	1,537	17,142	15
T HAMMOND	1,986	253	2	15,446	167	338	1,430	19,622	2
T HUDSON	7,768	395	181	2,503	67	275	813	12,002	9
T KINNICKINNIC	2,677	49	0	13,421	156	797	846	17,945	14
T PLEASANT VALLEY	601	11	0	8,898	120	96	705	10,431	4
T RICHMOND	3,195	293	93	11,833	150	440	1,607	17,610	35
T RUSH RIVER	508	5	0	8,162	134	310	1,111	10,229	6
T SOMERSET	6,132	281	11	7,318	141	1,425	1,300	16,607	60
T SPRINGFIELD	7,061	475	0	10,092	45	2,437	3,226	23,336	52
T ST. JOSEPH	704	53	0	12,303	217	1,584	3,272	18,133	51
T STANTON	733	44	40	14,055	161	728	1,216	16,977	38
T STAR PRAIRIE	4,125	275	104	6,795	132	1,180	3,414	16,026	165
T TROY	5,167	433	4	11,958	71	647	969	19,250	83
T WARREN	2,362	224	0	13,306	147	1,040	762	17,842	7
V BALDWIN	84	109	124	229	0	15	52	612	65
V DEER PARK	31	3	0	163	2	62	53	314	2
V HAMMOND	196	61	26	685	2	4	84	1,057	35
V NORTH HUDSON	22	23	1	0	0	0	0	46	12
V ROBERTS	39	58	10	267	0	18	49	440	145
V SOMERSET	150	182	58	29	0	5	317	741	2
V SPRING VALLEY *	12	0	0	59	0	17	87	175	0
V STAR PRAIRIE	264	11	0	485	7	110	44	922	3
V WILSON	76	0	0	222	1	49	560	909	4
V WOODVILLE	218	64	53	144	2	43	38	562	80
C GLENWOOD CITY	366	41	10	369	0	10	45	841	48
C HUDSON	535	830	75	0	0	0	0	1,440	18
C NEW RICHMOND	391	49	166	985	0	11	85	1,687	35
C RIVER FALLS *	86	102	50	85	0	14	4	341	38
ST. CROIX COUNTY	**51,171**	**4,613**	**1,166**	**252,754**	**3,207**	**22,151**	**36,684**	**371,746**	**1,131**
percentage	13.8%	1.2%	0.3%	68.0%	0.9%	6.0%	9.9%	100.0%	

source: St. Croix County Land Information Office – Parcel/Assessment Database; mobile home data from 2000 U.S. Census

Table 10 shows the assessed value of improvements by use and municipality as of 2006.

TABLE 10. Assessed Value by Land Use by Municipality -- 2006
St. Croix County and Municipalities

Type and Name of Municipality	2006 Improvement Value					Tax Exempt Acres
	Resid.	Comm.	Manuf.	Ag. Bldgs	Total	
T BALDWIN	$42,185,300	$2,501,200	$0	$11,268,500	$55,955,000	107.3
T CADY	$32,892,800	$2,110,100	$2,566,400	$10,787,400	$48,356,700	579.8
T CYLON	$28,087,700	$1,650,200	$1,485,800	$6,691,200	$37,914,900	2,835.8
T EAU GALLE	$44,483,700	$1,127,400	$0	$5,636,900	$51,248,000	194.2
T EMERALD	$25,847,800	$328,200	$0	$9,839,800	$36,015,800	30.2
T ERIN PRAIRIE	$39,961,600	$178,200	$0	$5,108,700	$45,248,500	576.2
T FOREST	$16,564,600	$633,100	$0	$11,249,200	$28,446,900	34.0
T GLENWOOD	$30,460,900	$454,000	$0	$8,917,500	$39,832,400	58.8
T HAMMOND	$95,978,200	$2,394,400	$70,300	$6,897,000	$105,339,900	285.3
T HUDSON	$584,255,400	$21,024,600	$7,576,200	$4,204,600	$617,060,800	2,639.7
T KINNICKINNIC	$119,251,900	$353,100	$0	$8,356,800	$127,961,800	467.7
T PLEASANT VALLEY	$17,818,700	$343,200	$0	$3,964,200	$22,126,100	245.8
T RICHMOND	$138,453,600	$3,459,700	$973,000	$5,052,300	$147,938,600	1,148.0
T RUSH RIVER	$26,014,900	$292,500	$0	$7,757,600	$34,065,000	209.3
T ST. JOSEPH	$245,265,300	$5,638,100	$323,200	$4,349,900	$255,576,500	1,973.7
T SOMERSET	$197,447,700	$6,042,000	$0	$1,925,900	$205,415,600	3,081.3
T SPRINGFIELD	$29,341,400	$370,550	$0	$10,312,350	$40,024,300	719.2
T STANTON	$41,714,500	$449,200	$0	$6,909,200	$49,072,900	2,422.4
T STAR PRAIRIE	$183,111,800	$5,977,300	$233,200	$5,160,100	$194,482,400	1,409.0
T TROY	$391,681,100	$10,429,200	$65,200	$5,999,400	$408,174,900	796.8
T WARREN	$80,294,500	$1,870,800	$0	$5,467,000	$87,632,300	1,843.0
V BALDWIN	$132,018,700	$42,289,000	$14,381,300	$0	$188,689,000	119.0
V DEER PARK	$6,183,800	$989,000	$41,500	$31,600	$7,245,900	153.2
V HAMMOND	$67,578,800	$18,256,600	$7,114,800	$81,300	$93,031,500	156.3
V NORTH HUDSON	$195,299,500	$14,583,500	$143,500	$0	$210,026,500	12.0
V ROBERTS	$50,027,200	$8,432,000	$801,400	$0	$59,260,600	33.3
V SOMERSET	$97,141,600	$26,235,700	$10,656,700	$0	$134,034,000	149.6
V SPRING VALLEY *	$112,700	$0	$0	$0	$112,700	481.0
V STAR PRAIRIE	$24,830,200	$2,232,300	$34,900	$266,100	$27,363,500	121.2
V WILSON	$7,957,100	$389,800	$0	$25,200	$8,372,100	11.4
V WOODVILLE	$34,562,600	$7,993,600	$7,560,900	$115,200	$50,232,300	204.5
C GLENWOOD CITY	$41,426,900	$11,966,400	$405,400	$0	$53,798,700	66.5
C HUDSON	$610,043,800	$276,420,800	$23,511,100	$0	$909,975,700	125.4
C NEW RICHMOND	$259,696,100	$92,770,522	$16,115,200	$0	$368,581,822	61.9
C RIVER FALLS *	$106,319,000	$43,987,400	$14,903,300	$0	$165,209,700	44.6
ST. CROIX COUNTY	**$4,044,311,400**	**$614,173,672**	**$108,963,300**	**$146,374,950**	**$4,913,823,322**	**23,397.4**

source: St. Croix County Land Information Office – Parcel/Assessment Database

This data is important in helping to determine the potential vulnerabilities to impacts of a hazard event. For instance, most, if not all, of the $4.9 billion in improvements would be vulnerable to the impacts of a tornado to some degree.

The assessment data will be used further in the vulnerability assessment, in particular when identifying potential floodplain parcels. For reference, Table 10 includes the tax exempt acreage which may include improvements (e.g., church, camp buildings, municipal facilities) which would also be vulnerable to hazards.

Figure 7 shows the generalized land covers throughout St. Croix County based on satellite imagery taken in the early 1990s. Though older, it does provide a visual reference point for the distribution of land cover in the County; more current land-use cover data is not available countywide. As reflected in Figure 7, the majority of St. Croix County remains largely rural which presents related challenges and limitations when planning for emergency services or analyzing the feasibility of alternative mitigation strategies. Meanwhile, additional services may be expected or needed in the quickly developing western portions of the County.

Assuming that present and projected trends continue, most of the land in St. Croix County will remain primarily in agriculture and forests for the foreseeable future. Residential and commercial growth will continue in the western portions of the County and along major highways (e.g. I-94, STH 35/64). Pressure to develop or convert shoreland lots and cottages to full-time residences will also continue. And high land values in some areas will likely make manufactured housing unfeasible, while alternative forms of higher density development may become more common (e.g., duplexes, condominiums, conservation design subdivisions).

With development comes a correlated increase in the value of property and the number of residents which will be potentially vulnerable to hazard impacts. Likewise, the need for additional emergency response planning and emergency services will also increase. But development can also contribute to the risk of a hazard incident occurring.

Development can impact natural systems, such as potentially decreasing flood storage or increasing stormwater runoff. For instance, between 1973 and 1993, it was estimated that wetlands and surface waters in St. Croix County decreased by 4,740 acres. Additional services and industry would undoubtedly increase the potential for hazardous materials spills, possibly due to a traffic accident as traffic volumes increase. Additional homes would also increase the demand on groundwater, which could eventually become a concern in times of extended drought, such as in areas with heavy agricultural irrigation. These potential risks and vulnerabilities will be analyzed later in this plan.

FIGURE 7. St. Croix County Land Cover -- 1992

E. CRITICAL FACILITIES

For the St. Croix County all-hazards mitigation planning effort, a critical facility is defined as either:

(1) a facility in either the public or private sector that provides essential products or services to the general public, is otherwise necessary to preserve the welfare and quality of life in St. Croix County, or fulfills important public safety, emergency response and/or disaster recovery functions; or

(2) a high potential loss facility (e.g., nuclear plant, military installation) with high impacts or possible substantial secondary impacts resulting from a hazard event, but not necessarily a facility which is considered essential for the community.

The identified primary critical facilities include:

- Pre-K thru 12 public and private schools, plus the technical school (34 facilities)
- communication towers (12 facilities)
- infrastructure and utilities
- emergency services providers (24 facilities)
- airports and airstrips (10 facilities)
- hospitals and medical clinics (6 facilities)
- nursing homes (16 facilities)

Most of the above facilities are considered essential due to the public services or emergency responses they provide (i.e., law enforcement, infrastructure, hospital). Educational facilities and nursing homes perform an important public welfare function to potentially vulnerable populations. As the transportation section will later describe, the New Richmond airport is the only public airport in the County; the other nine private airstrips are relatively small and may not be deemed critical facilities.

The primary critical facilities for St. Croix County are identified in **Appendix E**, with an accompanying map of approximate locations, largely taken from FEMA HAZUS data.[5] The far majority of these facilities are located within incorporated areas, with the exception the communication towers. The majority of these facilities are owned by a governmental or non-profit entity and are not assessed for tax purposes; as such, the value of many of these facilities is not readily available.

Not shown in Appendix E are all of the village, city, and town municipal buildings, town halls, and maintenance garages for the communities in the County which could potentially be considered critical facilities for their individual communities. The exception to this is when an emergency services provider is located in the same structure as other municipal services (e.g., Glenwood City, County Government Center). But, specific location information was not readily available for many of these individual structures or utilities, especially for the rural towns when post office boxes are more commonly used.

[5] Federal Emergency Management Agency. HAZUS-99 for Arc View, Service Release 2. January 2002.

Also not included in Appendix E are the 91 licensed child care facilities located throughout the county. These facilities have a licensed capacity of 6 to 120 children. To overcome these weaknesses in the data, communities were asked to identify any known risks or vulnerabilities to such critical facilities during interviews, meetings, and surveys.

The following additional types of important facilities which are not included in Appendix E have been addressed individually in subsequent Plan sub-sections:

- transportation systems
- historic structures & sites
- extremely hazardous substance (EHS) planning facilities

The risk and vulnerability assessment (**Section III.B.**) further analyzes each type of facility to determine which is more likely to be affected by hazards. For instance, the known locations of these critical facilities are compared to floodplain maps to identify potential flooding risks. And for the incorporated areas, orthophotos with floodplains shown were used during meetings with each community to identify whether a utility (e.g., wastewater treatment plant) or other critical municipal structure were located within a floodplain or other floodprone area, even though each structure was not later individually mapped.

No high potential loss facilities were identified in St. Croix County, such as military installations or a nuclear facility, though the County is within the ingestion pathway zone of the Prairie Island Nuclear Generating Facility, which will be discussed later in this report. Some of the largest dams of St. Croix County or upstream of the County do have some characteristics of high potential loss facilities and are discussed as part of the flood vulnerability assessment.

F. HAZARDOUS MATERIAL STORAGE AND USE

Hazardous materials can present special risks to humans and the environment at the time of disaster, as well as pose substantial difficulties and necessitate special precautions for post-disaster clean-up.

According to data from Wisconsin Emergency Management for 2006, there are 86 Tier Two reporting facilities and 32 Extremely Hazardous Substances (EHS) planning facilities within St. Croix County. Tier Two facility reports are submitted annually, by law (SARA Title III), for any facility that is required to prepare or have available a Material Safety Data Sheet (MSDS) for a hazardous chemical present at the facility.

EHS (Extremely Hazardous Substances) facilities store and/or use one of over 300 chemicals with extremely toxic properties. In addition to the MSDS reporting requirements, EHS facilities (or planning facilities) must cooperate with St. Croix County Emergency Management and the Local Emergency Planning Committee (LEPC) to develop an emergency response plan. It is also notable that nine of the EHS facilities in St. Croix County were municipal wastewater treatment or well utilities.

Of the 32 EHS planning facilities, 23 were located in incorporated areas, assumingly with access to municipal water and sewer. And from a cursory review, the far majority of tier-two facilities were also located in incorporated areas. In addition, the previously noted FEMA HAZUS

database includes 205 facility records of hazardous materials facilities in St. Croix County drawing this information from a variety of sources, though some of the records are duplicated or may be outdated.[6] The HAZUS database does include location information for these facilities, but the accuracy is questionable for many records.

The location of the HAZUS facilities and EHS planning facilities were compared against floodplain maps to identify possible vulnerabilities to flooding as will be discussed later during the flood hazard assessment. Review of orthophotos and additional follow-up research was performed as necessary.

Also, during Steering Committee meetings and the key-informant interview process, no unique hazard vulnerabilities were identified for any of the Tier Two or EHS facilities other than the potential for a hazardous materials release which will be discussed in greater detail in the hazards assessment later in this report. For security reasons, more specific information and maps pertaining to these facilities (e.g., addresses, names, chemical types) are not included within this report.

Also not mapped for security reasons were portions of three natural gas transmission lines and an oil pipeline which run through portions of the County. Northern Natural Gas operates two of the natural gas transmission lines (one each in the Town of Star Prairie area and Town of Pleasant Valley areas). A third natural gas transmission line owned by Viking Gas runs through the Town of Forest area. The oil pipeline owned by Williams Pipeline Company generally runs from the Hudson area southeast to the Town of Kinnickinnic then east through the southern tied of towns in the County.

G. TRANSPORTATION SYSTEMS

The transportation system of St. Croix County has been a major factor in the County's growth and economic trends. From 1971 to 1995, traffic volumes on the far majority of roadways at least doubled, with some volumes increasing up to eight and one-half times. Traffic volume growth rates have been greatest west of State Highway 65, reflecting population growth trends. In 2000, approximately 37% of all employed persons in St. Croix County commuted to the Minnesota counties of Washington, Ramsey, or Hennepin.

St. Croix County is directly on the Interstate 94 corridor, the principal arterial between Minneapolis-St. Paul and destinations to the east, such as Milwaukee and Chicago. Traffic on the Eau Claire-Hudson portion of the Interstate which runs through St. Croix County has been growing significantly. This stretch of Interstate 94 experiences traffic volumes of 40,000 to 70,000 vehicles a day and is the second most-traveled segment of interstate highway in the State of Wisconsin. By 2020, average daily traffic volumes at the I-94 bridge over the St. Croix River are projected to exceed 85,000 vehicles per day.

[6] Hazardous materials facilities noted in the HAZUS database were taken from the Toxic Release Inventory, Resource Conservation Recovery Information System, Air Facility System, CERCLIS, PCD Handler Activity Data System, Permit Compliance System, and the Section Seven Inventory System.

The County is also serviced by U.S. Highway 12, U.S. Highway 63, and seven State highways—STH 29, STH 35, STH 46, STH 64, STH 65, STH 128, and STH 170. These transportation routes and other transportation systems are shown on **Figure 8**.

In all, the County is served by 1,864 miles of centerline roads under federal, state, county, and local municipal jurisdiction as of December 31, 2004, though these numbers are constantly changing due to growth and jurisdictional transfers. The road mileage in St. Croix County by ownership jurisdiction is summarized in **Table 11** on the following page.

TABLE 11. ROAD MILEAGE (CENTERLINE) BY JURISDICTION • 12/31/04 ST. CROIX COUNTY

Jurisdiction	Miles	Percent of Total
Federal/State	202	10.8%
County	329	17.7%
Local Roads	1,333	71.5%
TOTAL	1,864	100.0%

Source: St. Croix County Highway Department

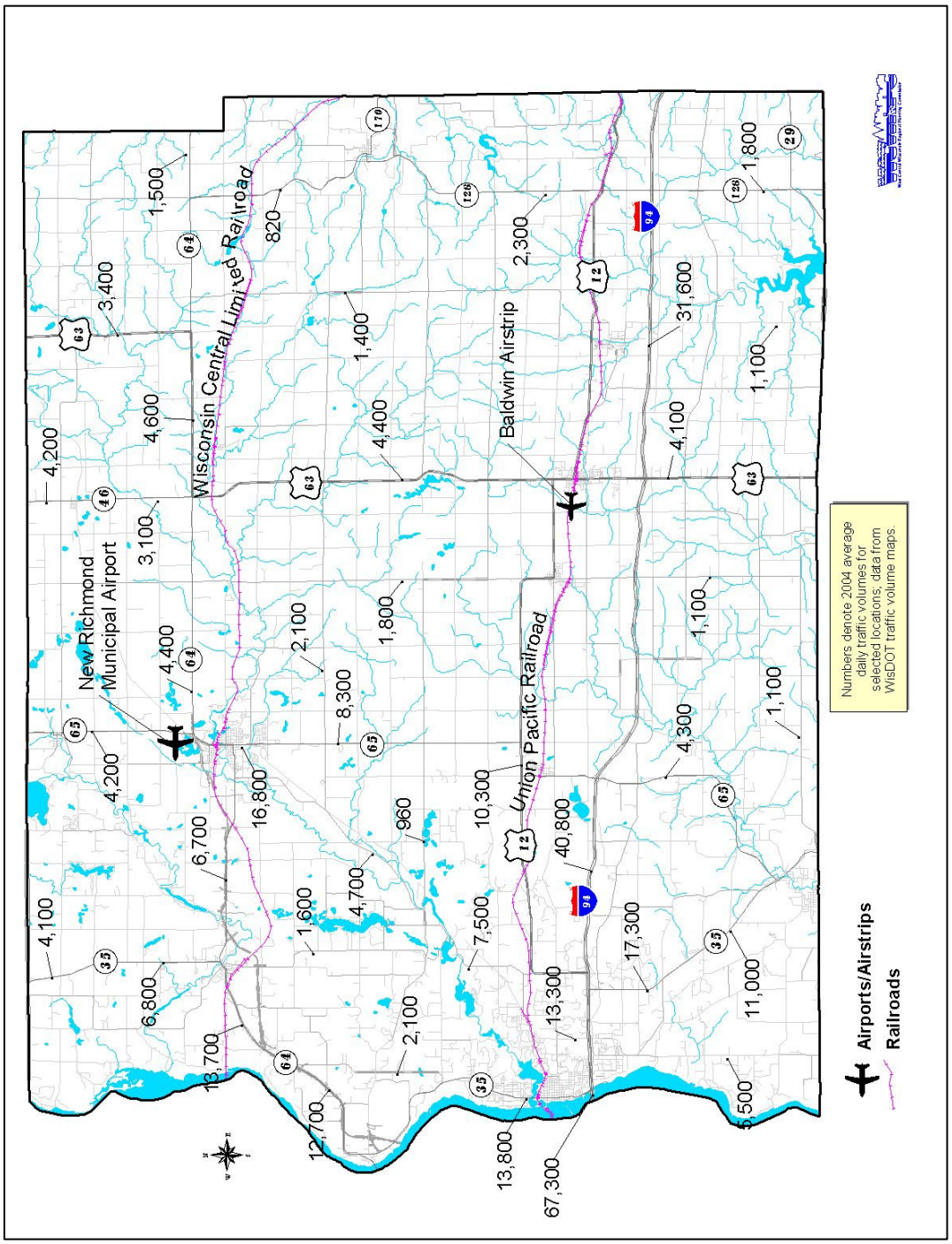
The New Richmond Municipal Airport is the only public airport located in St. Croix County and is the fifth largest municipal airport in Wisconsin with two runways and averaging 122 flights per day. In the past 30 years, there have been four major crashes at the airport resulting in seven deaths, with one of the crashes occurring in a nearby residential neighborhood. A smaller private airstrip located northwest of Baldwin is open from May through November, averages 38 flights per week, and is used heavily by parachutists during the summer months. The nearby Lake Elmo airport (approximately 10 miles from Hudson in Minnesota) or the Minneapolis-St. Paul International Airport provide the primary scheduled passenger and commercial air services for St. Croix County. The approximate locations of the New Richmond and Baldwin airports/airstrips are shown on Figure 8. The critical facilities section previously identified eight other smaller airstrips located in the County.

Two railroad lines also serve the County as shown on Figure 8. The Union Pacific (UP) Railroad operates the former Chicago-Northwestern mainline between Minneapolis-St. Paul and Chicago. This line serves the St. Croix County communities of Hudson, Roberts, Baldwin, Hammond, Woodville, and Wilson. The Wisconsin Central Limited (WCL) line to the north provides shipper connections in Minnesota for the communities of Somerset and New Richmond. No passenger rail service is currently available.

Other than for recreational purposes (e.g., hiking, biking, canoeing) or short commutes, other transportation systems are limited. A long-range bicycle plan for the County has been adopted which promotes the development of the bikeway system. Shared-ride taxi services are available within a five-mile radius of River Falls and in the New Richmond area. Special transportation services for the elderly and handicapped are coordinated through the St. Croix County Department on Aging, providing approximately 43,000 rides annually as of 2000. The demand for paratransit and public transit is expected to continue to grow as elderly and commuter populations increase.

The most significant transportation project receiving recent attention is the construction of a new Highway 63 bridge from Stillwater, Minnesota, to unincorporated Houlton, Wisconsin, about 8 miles north of Hudson. Due to budget challenges, the exact timeline for this project is not known, though the new bridge is expected to be complete within the next five to ten years. The new bridge would replace the current Stillwater Lift Bridge managed by the Minnesota Department of Transportation. The current lift bridge serves about 17,000 vehicle trips in an average day and has been closed on numerous occasions due to flooding and ice damming.

Figure 8. St. Croix County Transportation System



H. HISTORIC PROPERTIES AND DISTRICTS

Historic structures, sites, and districts are often targeted for hazard mitigation strategies due to their unique, often irreplaceable, social value. According to the National Register of Historic Places,[7] St. Croix County has a total of thirty-three historic properties, districts, and sites which are shown in the **Table 12** below.

Table 12: St. Croix County Historic Properties

	Structure/District	Address	City	Listed
1	Lewis Farmhouse	Farm Dr.	Boardman	3/19/1982
2	Stillwater Bridge	MN 36/WI 64 over St. Croix River	Houlton	5/25/1989
3	Moffat, John S., House	1004 3rd St.	Hudson	7/18/1974
4	Opera Hall Block	516 2nd St.	Hudson	3/7/1979
5	St Croix County Courthouse	904 3rd St.	Hudson	3/9/1982
6	Darling, Frederick L., House	617 3rd St.	Hudson	10/4/1984
7	Dwelley, William, House	1002 4th St.	Hudson	10/4/1984
8	Hudson Public Library	304 Locust St.	Hudson	10/4/1984
9	Humphrey, Herman L., House	803 Orange St.	Hudson	10/4/1984
10	Johnson, August, House	427 St. Croix St.	Hudson	10/4/1984
11	Johnson, Dr. Samuel C., House	405 Locust St.	Hudson	10/4/1984
12	Merritt, Samuel T., House	904 7th St.	Hudson	10/4/1984
13	Second Street Commercial District	Roughly 1st, 2nd, Walnut, & Locust	Hudson	10/4/1984
14	Sixth Street Historic District	Roughly 6th St. between Myrtle & Vine	Hudson	10/4/1984
15	Williams, T.E., Block	321 2nd St.	Hudson	10/4/1984
16	Lewis-Williams House	101 3rd St.	Hudson	1/2/1985
17	Phipps, William H., House	1005 Third St.	Hudson	6/18/1987
18	Kinnickinnic Church	WI J, jct. with WI JJ	Kinnickinnic	10/6/2000
19	Bell, Marcus Sears, Farm	1100 Heritage Dr.	New Richmond	5/31/1988
20	Bernd, William J., House	210 Second St., E	New Richmond	5/31/1988
21	Bernd, William J., House	143 Arch Ave., N	New Richmond	5/31/1988
22	Epley, Dr. Frank W., Office	137 Third St., E	New Richmond	5/31/1988
23	First English Lutheran Church	354 Third St., N	New Richmond	5/31/1988
24	Glover, Ezra, Jr., House	415 Second St., E	New Richmond	5/31/1988
25	Kell, William H., House	215 Green Ave., S	New Richmond	5/31/1988
26	Mielke, Joseph, House	326 Second St., W	New Richmond	5/31/1988
27	New Richmond News Building	145 Second St., W	New Richmond	5/31/1988
28	New Richmond Roller Mills Co.	201 Knowles Ave., N	New Richmond	5/31/1988
29	New Richmond West Side Historic District	Roughly bounded by Willow River, Minnesota Ave., W. Second St., S. Washington Ave.	New Richmond	5/31/1988
30	Soo Line Depot	120 High St.	New Richmond	5/31/1988
31	Thompson, Erick J., House	350 Second St., W	New Richmond	5/31/1988
32	Chicago, St. Paul, Minneapolis and Omaha Railroad Car Shop Historic District	Roughly bounded by Gallahad Rd., Sommer, 4th and St. Croix Sts.	North Hudson	10/4/1984
33	Soo Line High Bridge	Address Restricted	Somerset	8/22/1977

[7] National Park Service. National Register Information System Web Page. last updated March 16, 2006. <http://www.nr.nps.gov/nrloc1.htm>.

Fifteen of the above 33 historic sites are located within the City of Hudson. An additional 13 are located within the City of New Richmond. The list includes four historic districts—2 in Hudson, 1 in New Richmond, 1 in North Hudson—which encompass numerous buildings. Two of the structures are bridges which could be particularly vulnerable to flooding and ice damming.

During the next 5-10 years, it is expected that travel on the Stillwater Lift Bridge will be limited to pedestrian and bicycle traffic once the four-lane, deck-tiered, steel arch bridge is constructed to the south. Though floods have closed the Lift Bridge in the past, the new bridge should not be prone to closure due to flooding, largely mitigating the impacts of flooding on this important river crossing for vehicular traffic. However, floods and ice dams will likely continue to threaten the historic Lift Bridge.

There are certainly other properties of historical significance to the community which exist in St. Croix County, but they are not currently on the National Register. The State Historical Society of Wisconsin maintains a database of at least 134 sites or structures of architectural, historical, and archeological significance distributed throughout the County, including the 33 properties on the National Register. To protect these sites from disturbance, a listing or map depicting their location is not included in this plan.

The historic properties of St. Croix County will be further considered during the vulnerability assessment of critical facilities as each hazard type is analyzed. Generally, the historic structures are very well constructed; and they continue to serve as an important vestige of St. Croix County's past.

Historic Stillwater Lift Bridge during April 2001 flood

SECTION III.

ASSESSMENT OF HAZARD CONDITIONS

In order to more effectively evaluate potential hazard mitigation alternatives and develop feasible strategies to address the risks associated with the identified hazards, the County must:

- identify the hazards which are thought to pose the greatest risk to the residents of the County;
- profile the extent and severity of past hazard events that have affected the County; and
- assess the vulnerability of the community to the risk of future hazard events.

A. HAZARD IDENTIFICATION

Although St. Croix County could potentially be at risk from a variety of different hazards, this Plan will attempt to narrow the scope to those hazards that pose the most substantial risks.

Hazards, as defined by FEMA, are events that threaten lives, property, or assets. They tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.

Typically, public health issues, such as West Nile Virus, Bird Flu, or HIV, are not commonly considered to be hazards or disasters within the planning scope of FEMA efforts. These health issues are typically not included in federal, state, and local all hazards mitigation plans. Mitigation actions to prevent communicable diseases or a pandemic would not be eligible for grant funding under the typical mitigation programs administered by FEMA or Wisconsin Emergency Management.

Public health issues are more often dealt with through preparedness plans developed by public health agencies and medical providers, such as the *Wisconsin Pandemic Influenza Preparedness Plan* developed by the Wisconsin Department of Health and Family Services in April 2004. Due to the high degree of transmissibility and morbidity of many diseases and viruses, significant and specialized planning for these are either underway or complete.

Most public health issues, such as West Nile Virus, are outside the scope of this all hazards mitigation plan. The St. Croix County Health Department or the Wisconsin Department of Health and Family Services can be contacted for more information on public health issues and planning efforts. However, St. Croix County officials expressed significant concerns regarding the threat and ongoing planning activities related to Pandemic Flu during this planning effort and determined that Pandemic or Bird Flu should receive special attention within this report.

i. Hazard Events Historical Summary

Past hazard statistics were helpful in determining what hazards should be evaluated in this Plan. The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) publishes National Weather Service (NWS) data describing past weather events and the resulting deaths, injuries, and damages associated with each of these events. This data can be further supplemented by local event data, such as the *2005 St. Croix County Hazard Analysis*. Those hazard events reported in the NCDC database are summarized in **Table 13** with the reported impacts of some events including Wisconsin areas outside St. Croix County (e.g., 1958 Colfax Tornado, widespread heat waves).

TABLE 13. Natural Hazard Events as recorded by NCDC St. Croix County (*some events and reported impacts are regional*)

Hazard Types	Available reports	# of event reports	Frequency of reported events (recent)	Deaths	Injuries	Reported Property Damage	Reported Crop Damage	Damage per reported event (recent)
Winter Storms (regional*)								
Extreme Cold/Windchill	1993-2005	4	1 every 2.5 yrs	1	0	$0	$0	$0
Freezing Rain/Ice Storm	1993-2005	6	1 every 1.8 yrs	0	0	$0	$0	$0
Blizzard/Heavy Snow	1993-2005	30	2.7 per year	0	0	$0	$0	$0
Extreme Heat (regional*)	1993-2005	7	1 every 1.6 yrs	57	0	$0	$0	$0
Flooding (some regional*)	1997-2005	6	1 every 1.3 yrs	0	0	$11,062,000	$0	$1,843,667
Severe Thunderstorm-Related Events								
Hail	1975-2005	57	4.1 per year	0	0	$3,253,529	$0	$135,564
Severe Lightning	1993-2005	3	1 every 3.6 yrs	1	3	$0	$0	$0
Thunderstorm/High Winds	1966-2005	99	5.3 per year	1	3	$8,122,927	$473,009	$134,312
Tornadoes								
Tornadoes	1951-2005	23	1 every 2.3 yrs	2	36	$204,071,756	$0	$8,872,685
Funnel Clouds	1997-2005	4	1 every 2 yrs	0	0	$0	$0	$0
Key Totals				**62**	**42**	**$226,510,212**	**$473,009**	

NOTES:
* data for regional events often encompass impacts and damages outside of St. Croix County, such as the heat-related deaths
-- some events or event days have multiple reports for different locations within St. Croix County
-- damage estimates for many events not available and do not include costs to suppress or mitigate an event, such as emergency personnel

Sources: National Climatic Data Center (NCDC) - 1950-2005 <http://www4.ncdc.noaa.gov/cgi-win/>. Damage estimates adjusted to 2006 dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

Table 13 shows that heavy snow and severe thunderstorm events, including hail and high winds, are the most frequently reported natural hazard events for St. Croix County. In terms of deaths and injuries, tornadoes have historically been the greatest risk to St. Croix County residents, with the 57 deaths associated with the widespread, regional extreme heat events almost all occurring in the highly urbanized area of Milwaukee County in southeastern Wisconsin.

Tornadoes have also been the most destructive natural hazard event for St. Croix County, though it should be noted that 20% of the reported property damage is associated with the June 1958 storm which caused great destruction to the Village of Colfax in Dunn County, with far less damage reported within St. Croix County.

Many events and types of damage go unreported. Table 13 does not reflect the man hours and costs associated with snow removal following the 30 heavy snow and blizzard

events, or the road maintenance and vehicular accidents following the six freezing rain and ice storm events. Most thunderstorms occur with minimal damage to real property and improvements, but the NCDC data often does not reflect the costly clean-up to local municipalities, utility companies, and property owners. NCDC data may also not reflect costs associated with emergency services, such as fire fighting personnel and law enforcement.

The NCDC data is also limited in the timeframe covered. Some events, such winter storms, extreme heat, and flooding were not included in the database until relatively recently. Also, the database is built on actual reports to the National Weather Service and does not reflect historical events proceeding NWS or its data collection. The tornado impacts would be greatly increased if the June 12, 1899, New Richmond tornado was included, which killed 117 County residents, injured about 200 others, and caused an estimated $13 million in damage in today's dollars.

The risks and vulnerabilities associated with the hazard events shown in Table 13 will be further analyzed later in this section of the Plan.

ii. Hazard Risk Assessment Survey & Prioritization

At the November 11, 2006, Steering Committee meeting, the historical summary of hazard events was discussed with the members of the St. Croix County Emergency Government and Communications Committee. Committee members were then asked to participate in a hazard risk assessment survey. This survey was used to help prioritize the hazard risks and vulnerabilities of St. Croix County.

For each hazard, each Committee member was asked to assign a risk rating of 0 to 5 (0-none, 1-low/minimal, 3-moderate/substantial, 5-very high/extreme) to reflect their opinion of which hazards pose the greatest risks and vulnerabilities. For this survey and Plan, ***risk*** is defined as the probability and frequency of occurrence in the future. ***Vulnerability*** is defined as the seriousness and extent of an event's impacts, should the event occur.

A composite overall average risk rating for each hazard was then calculated by totaling the average risk rating from each respondent and dividing by the total number of respondents. A total of thirteen surveys were completed.

Identification of the hazards for inclusion in the survey was based on the hazards identified in the *Resource Guide to All Hazards Mitigation Planning in Wisconsin* prepared by the Sate Department of Military Affairs, Wisconsin Emergency Management. This list was further amended based on the previous review of historical data for St. Croix County and discussion with the Steering Committee.

Shown in **Table 14** is the summary of average risk and vulnerability ratings for each of the above hazards according to the Steering Committee.

Tornado and high wind events ranked highest overall, with high or serious impacts possible when an event does occur (vulnerability of 4.00 out of 5.00). Only pandemic flu

was ranked as having a potential higher vulnerability, but the potential risk of occurrence was ranked much lower than tornadoes.

The majority of events were ranked as having a low-to-moderate rate of occurrence and less than substantial impacts when the events do occur. Unlike tornadoes and high winds which do not occur frequently, but can have serious impacts when they do occur, many more events were rated as having a high frequency of future occurrence (e.g., moderate to high risk) but were anticipated to have lower impacts (e.g., moderate to low vulnerability), such as snow storms and extreme cold.

TABLE 14. Overall Average Risk & Vulnerability Survey St. Croix County

Hazard	Overall Avg. Risk Ranking	Overall Avg. Vulnerability Ranking	Combined Average Ranking
Tornadoes & High Winds	3.67	4.00	3.84
Ice Storms & Sleet	3.78	3.67	3.73
Pandemic Flu	2.89	4.11	3.50
Heavy Snow & Blizzards	3.89	3.00	3.45
Hazardous Materials Spills	3.11	3.67	3.39
Thunderstorms, Hail, etc	3.56	3.11	3.34
Extreme Cold	3.67	2.89	3.28
Groundwater Contamination	2.78	3.44	3.11
Drought	2.78	3.11	2.95
River and Overbank Flooding	2.67	2.78	2.73
Nuclear Accident (IPZ)	1.56	3.89	2.73
Terrorism, Domestic	2.00	3.00	2.50
Extreme Heat	2.33	2.44	2.39
Stormwater and Overland Flooding	2.33	2.56	2.45
Terrorism, International	2.00	2.67	2.34
Dam Failure Flooding	1.67	3.00	2.34
Forest or Wild Fire	1.56	2.22	1.89
Landslides and Land Subsidence	1.22	1.78	1.50
Earthquakes	0.78	1.33	1.06

While the rankings are somewhat subjective, the survey does provide important insight into the relative disaster risks and vulnerabilities for St. Croix County. Based on the survey results, it was determined to exclude extreme heat, terrorism, forest and wild fires, landslides/land subsidence, and earthquakes from the full hazards assessment due to the low risk and vulnerability from these hazards in St. Croix County. Stormwater and overland flooding and dam failure flooding were integrated into a general flooding category which will be fully assessed.

Three non-natural hazards were ranked high enough to receive special attention in this report, but these three hazards are typically outside the scope of most hazard mitigation plans. Pandemic flu, nuclear accidents, and hazardous materials spills will each be analyzed within the hazard assessment and any related strategies incorporated within the

plan. However, the analysis will largely reference other existing planning and mitigation efforts and may be less robust when compared to the highly ranked natural hazards (e.g., flooding, tornadoes, winter storms). Based on discussions with the Steering Committee, groundwater contamination will focus on point-source concerns and be discussed in the context of hazardous materials spills.

The purpose of reviewing past frequency and severity data (Table 13) and rating the potential risks associated with each hazard (Table 14) is to identify and address those hazards posing the greatest threat to residents and property. In short, the Steering Committee identified the following hazards to be the focus of the Plan's assessment, goals, and strategies based on their probability of occurrence in the future and likelihood of significant impacts:

- tornadoes and high winds
- winter storms & extreme cold (includes heavy snow, blizzards, and ice storms)
- thunderstorms (includes lightning, hail, and high winds)
- drought
- flooding (includes flash/stormwater flooding, lake/river flooding, & dam failure)

In addition, the Steering Committee recommended that the risk and vulnerability assessment include a general overview of the following hazard types given the potential for severe impacts:

- pandemic flu
- hazardous materials incidents (includes groundwater contamination)
- nuclear accident (ingestion pathway zone)

iii. Other Natural Hazards of No Significant Risk

Although there are other hazards that could potentially impact the County, there are no records of these events occurring in St. Croix County in the NOAA database. In order to meet the comprehensive requirements for developing an all hazards mitigation plan, these other natural hazards are identified and described below.

It is important to note that these hazard events may still pose some threat to the community, but they were considered by the Committee to either have a minimal chance of occurring, pose a minimal risk to the safety of residents or property, or offer only very limited mitigation options.

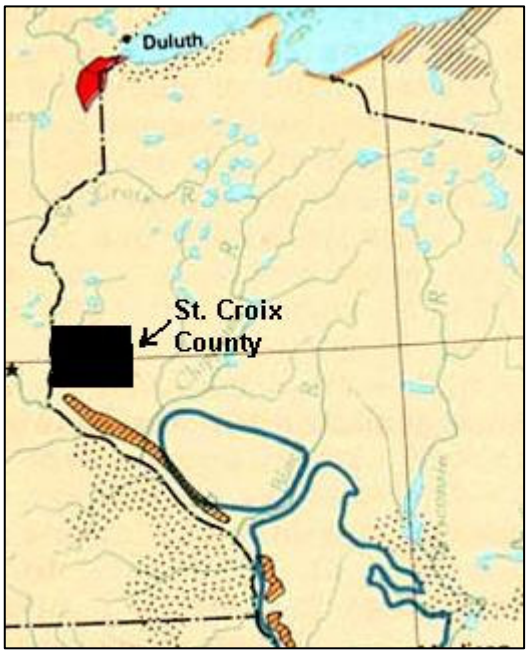
Fog

Fog is low-level moisture that can reduce visibility. It can occur in isolated low-lying areas or be a widespread event that can cover several counties. In general, fog is often hazardous when the visibility is reduced to 1/4 mile or less. Thick fog reduces visibility, creating a hazard to motorists as well as to air traffic. Airports may close because of heavy fog. The intensity and duration of fog varies with the location and type of fog. Generally, strong winds tend to prevent fog formation. In St. Croix County, fog occurs infrequently and is typically a short-term weather event lasting only for portions of a day.

Landslides

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on a steep slope is the primary reason for a landslide, there can be other contributing factors. Erosion by rivers, excess weight from accumulation of rain or snow, or from man-made structures may stress weak slopes to failure. Slope material that becomes saturated with water may develop a debris flow or mudflow.

FIGURE 9. Landslide Incidence and Susceptibility in Wisconsin



source: U.S. Geologic Service. Landslide Overview Map of the Conterminous United States.

The USGS *Landslide Overview Map of the Conterminous United States*[8] (excerpt for Wisconsin in **Figure 9**) identifies no large-scale landslide incidences or susceptibilities for St. Croix County. St. Croix County falls within the low landslide incidence area (yellow area on the map) with no landslide susceptibilities identified (shaded areas). There are no other records of large landslide events in the County.

Smaller, localized areas susceptible to landslides or severe erosion can occur along steep slopes. According to the USGS topographic maps and U.S. Natural Resources Conservation Service soil maps for St. Croix County (see Figure 5), the steepest slopes in St. Croix County (20% slope or greater) can be found in the western third of the County as well as in far eastern portions (e.g., Glen Hills area). Many of these steepest slopes are along rivers and lakes, which may be susceptible to erosion from stormwater runoff, riverine flooding, and normal wave action. Development activity, intensive agricultural practices, and logging can all increase the risk of erosion or smaller "localized landslides."

Such localized erosion within the County is not uncommon and is often the result of human impacts (e.g., removal of vegetation), but would not be classified as a natural hazard due to its scale, impacts, and gradual nature. In comparison, the sudden, large-scale movement of ground which is characteristic of a landslide is not expected to occur in St. Croix County; and there are no records of large landslide events in the County. Overall, the erosion which does occur has been largely mitigated through subdivision law, site plan review, forest management plans, agricultural practices, and erosion control plans for construction sites. However, during the planning process, some erosion problem areas associated with flooding were identified and will be discussed later in this report.

[8] U.S. Geological Survey. Landslide Overview Map of the Conterminous United States. <http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html>

Land Subsidence

Land subsidence is an event in which a portion of the land surface collapses or settles. Common locations of subsidence are in areas having karst topography or in areas in which large amounts of ground water have been withdrawn.

Closed depressions are common features in St. Croix County. They can be formed through karst topography which is particularly well developed in the eastern half of the County or through the kettle depressions remaining from glaciation which are not uncommon in the western and northwestern portions of the County.

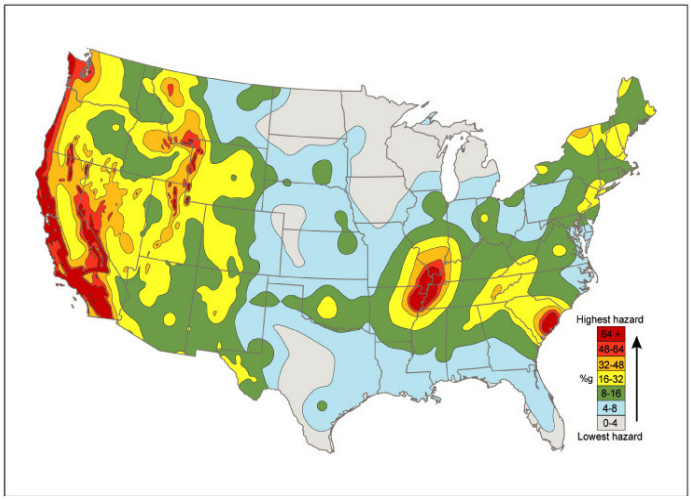
Karst development occurs from thick, soluble areas of underground limestone which dissolve over time, forming sinkholes. Kettles develop when large blocks of glacier ice are buried with glacial deposits and subsequently melt.

There are no records of substantial damage or injury from land subsidence within St. Croix County. The only damage event noted during the planning process was the reported opening of a sinkhole under a tractor during field work. However, closed depressions are considered environmentally sensitive features since the release of pollutants into or near a closed depression can reach groundwater immediately. As such, these closed depressions will be discussed further within the discussion of hazardous materials spills and groundwater contamination.

Earthquakes

According to the U.S. Geological Survey, there have been 19 earthquake events in Wisconsin, none being noted for west-central Wisconsin. Where readings are available, these events were relatively small, most being 3.0-3.8 on the Richter Scale in size and the largest being an intensity of 5, which may be strong enough to crack some plaster, but not cause serious damage. Due to the lack of recent events, some geologists question whether many of these events were true earthquakes, but rather quarry collapses, blasts, etc.

FIGURE 10. U.S. Geological Survey Earthquake Hazard-Shaking Map



source: U.S. Geological Survey. Earthquake Hazard in the Heart of the Homeland. <http://pubs.usgs.gov/fs/fs-131-02/CUShazard.html>.

The nearest active earthquake fault outside of Wisconsin is the New Madrid Fault which has a seismic zone which stretches from northeast Arkansas to southern Illinois.

As **Figure 10** shows, the St. Croix County area falls within the lowest earthquake hazard-shaking area, with the different colors representing the levels of

horizontal shaking that have a 1-in-50 chance of being exceeded in a 50-year period. Similarly, St. Croix County falls within a 0%g peak ground acceleration (PGA) zone as shown on the USGS PGA values map for the United States with a 10% chance of being exceeded over 50 years; St. Croix County is a non-affected area.[9]

University of Wisconsin-River Falls students and geologists have studied an ancient major fault line which is located approximately 2 miles south of Hudson and extends north towards Willow River State Park and west towards Hastings, MN. Called the Hastings Fault, it has characteristics similar to the New Madrid Fault; but there has been no evidence of any motion on the Hastings Fault for the last 400 million years. While an earthquake along the Hastings Fault could be catastrophic, geologists estimate that no significant effects on this fault will likely occur within the next few millions years. As such, the earthquake threat to St. Croix County is considered very low.

Coastal Hazards (Hurricanes, Tsunamis, Tidalwaves, Riptides, etc)

Coastal hazards can cause increases in tidal elevations (storm surges), high winds, and erosion caused by tropical cyclones (such as hurricanes) or the sudden displacement of water (such as tsunamis from earthquakes). St. Croix County is located in the upper Midwest, approximately 1,000 miles from the Atlantic Ocean, 1,200 miles from the Gulf of Mexico, and 2,000 miles from the Pacific Ocean. St. Croix County also has no very large inland lakes or seas within its boundaries. Such coastal hazards have no direct impact on St. Croix County, and only occasionally indirectly impact the County in the form of thunderstorms, which are discussed separately. There have been reported instances of waterspouts on Lake St. Croix, but these are not unique coastal hazards in the County, primarily being associated with tornadoes. For example, the 1899 New Richmond tornado was reported as a waterspout as it passed over Lake St. Croix.

Forest & Wild Fires

A wildfire is an uncontrollable fire spreading though vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires can be human-caused through arson, campfires, or other carelessness, or can be caused by natural events such as lightning. A wildfire occurring on forest or woodlands, typically outside the limits of incorporated villages and cities, is commonly referred to as a forest fire. Forest and wild fires can cause significant injury, death, damage to property, and loss of natural resources.

Land use, vegetation, amount of combustible materials present, and weather conditions (e.g., wind, low humidity, lack of precipitation) are the chief factors determining the number of fires and acres burned. Forest and wild fires are more likely when vegetation is dry from a winter with little snow cover, followed by a spring and summer with sparse rainfall. As development within forested areas increases, especially within pine plantation, so does the risk for forest fire.

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[9] U.S. Geologic Service. Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years. map. <http://geohazards.cr.usgs.gov/eq/pubmaps/US.pga.050.map.gif> November 1996.

There are no County Forest lands in St. Croix County and no large areas of pine forest. WISCLAND satellite data from 1993 can be used to generally classify vegetative land cover by canopy type. In 1993, approximately 19% of the County was in forest or forested wetlands. Over 94% of the forest land cover in St. Croix County was identified as being broad-leaved deciduous (e.g., aspen, oak, maple, birch), which has a relatively low vulnerability to forest fire. Only 4.4% of the forest land cover was coniferous softwoods, such as pines and spruces, which have a significantly higher vulnerability to forest fire. Less than 1% of the forest land cover was classified as mixed deciduous and coniferous. The coniferous and mixed forests of St. Croix County are scattered throughout the county with the largest contiguous block being approximately 94-acres in size along the St. Croix River in the Town of Troy. The far majority of the tracts of softwoods found in the County were less than 10 acres in size.

All of St. Croix County falls within the lowest forest fire level of protection (LOP 5) as assigned by the Wisconsin Department of Natural Resources based on fuel types and number of improved parcels (vulnerabilities). No part of St. Croix County is within a Wisconsin Department of Natural Resources extensive or intensive fire protection area.

Between 1982 and 2003, only fourteen forest or wild fires for St. Croix County were recorded in the Wisconsin DNR database. Of these, only two were of significant size—a 152-acre fire cause by campfire at a party and an 81-acre fire purposely started with an incendiary. Both of these fires occurred east of the Boardman area. Ten of the fourteen reported fires were less than three acres in size. Campfires and purposely set incendiary fires were the two most common causes attributed to these reported fires, with five fires each. Two reported fires were associated with debris burning and one was related to the railroads. Contrary to commonly held beliefs, none of the reported fires was related to lightning strikes or smoking.

As records show, the occurrence of forest and wild fire is quite low in St. Croix County, with events typically involving small amounts of acreage and fire control costs exceeding actual damages. There is also a general consensus among most local officials that the existing forest fire risks in St. Croix County are largely mitigated to an extent which is reasonably feasible through appropriate forest management practices.

These findings are consistent with the perspectives of the Steering Committee which rated the forest and wild fire risks and vulnerabilities in St. Croix County as being very low (1.56 and 2.22 out of 5.00, respectively). As such, large forest and wild fires are considered not to be of significant risk to St. Croix County and its residents at this time and for the near future. However, related risks and vulnerabilities should be monitored since the level of risk and vulnerabilities could change with development patterns (e.g., subdivision development in pine plantation), vegetation changes (e.g., large plantings of pine forest), or climatic changes (e.g., lengthy periods of drought).

Extreme Heat

In contrast to other natural hazard events, the occurrence and impacts of extreme heat are often more difficult to recognize.

Excessive heat is a slowly evolving phenomenon that can catch many people by surprise. Unlike tornadoes or thunderstorms that normally develop and occur more quickly and with more observable characteristics, a heat wave typically builds slowly over time. Because of this creeping effect that can occur, it is important for forecasters and officials to be constantly aware of the heat and humidity conditions in order to properly warn and protect citizens of the risks.

Heat waves usually consist of high temperatures and high relative humidity. This combination makes it difficult for the human body to dissipate heat through the skin and sweat glands. Sweating will not cool the human body unless the water is removed by evaporation. High relative humidity retards evaporation and thus inhibits the cooling process. The National Weather Service (NWS) uses the heat index as a measure of the combined affects of high temperatures and high relative humidity, shown in **Table 15**.

TABLE 15. Heat Index Table
(Heat Index Values in Degrees Fahrenheit)

Temperature	Relative Humidity (PERCENT)								
(°F)	10	20	30	40	50	60	70	80	90
70	65	66	67	68	69	70	70	71	71
75	70	72	73	74	75	76	77	78	79
80	75	77	78	79	81	82	85	86	88
85	80	82	84	86	88	90	93	97	102
90	85	87	90	93	96	100	106	113	122
95	90	93	96	101	107	114	124	136	
100	95	99	104	110	120	132	144		
105	100	105	113	123	135	149			
110	105	112	123	137	150				
115	111	120	135	151					

Source: National Weather Service

From 1979 to 1999, excessive heat exposure caused 8,015 deaths in the United States. During this period, more people died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined. Although Wisconsin may not be thought of as a high risk area for deadly heat waves, every year, the State of Wisconsin experiences a period or series of periods in which the temperature and humidity produce a heat index which could be harmful to human health. The following are examples of recent heat wave events affecting Wisconsin:

- During the summer of 1995, two heat waves affected most of Wisconsin. Together, they resulted in 154 heat-related deaths and an estimated 300 to 400 heat-related illnesses. This makes the combined 1995 summer heat waves the biggest weather-related killers in Wisconsin for the past 50 years, far exceeding tornado deaths.
- In 1999, heat waves occurred on July 4th-5th, 23rd-25th, and 29th-31st. Collectively, these heat waves were directly and indirectly responsible for 20 deaths.
- Several heat waves from mid-July through early August 2001 claimed 15 fatalities across Wisconsin. Additionally, it is estimated that 300 or more individuals were treated at hospitals for heat-related conditions.

Extreme heat and droughts have no defined hazard area within St. Croix County and most times affect the entire County. Due to the irregular nature of these events and the lack of defined hazard areas, the assessment of community impacts as a result of extreme temperatures is difficult to quantify.

Temperatures in excess of 90°F pose a risk of heat-related illness and death, especially when humidity levels exceed 35%. The risk is highest for individuals who are suffering from chronic illnesses and for those who are not acclimated to these conditions. Most health-related illnesses involve the elderly, especially those residing in urban areas where temperatures can be further elevated due to the urban heat island effect. However, people on certain medications, isolated individuals who live alone and seldom leave their home, infants and young children, persons with chronic heart or lung problems, overweight people, persons with disabilities, and people who work outside are also at greater risk during extreme heat events. Research findings strongly suggest that heat index values of 90 to 105 make sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity. Heat index values of 105 to 130 degrees make sunstroke, heat cramps, and heat exhaustion likely with prolonged exposure and/or physical activity. Shown in **Table 16** is the heat stress index that identifies the potential dangers associated with heat index temperatures.

TABLE 16. Apparent Temperature Heat Stress Index (Dangers Associated with Heat Index Temperatures)

Category	Apparent Temperature (Heat Index - °F)	Associated Dangers
Caution	80-90°F	Exercise more fatiguing than usual.
Extreme Caution	90-105°F	Heat cramps, exhaustion possible.
Danger	105-130°F	Heat exhaustion likely.
Extreme Danger	Greater than 130°F	Heat stroke imminent.

Source: National Weather Service

Any time the temperature and humidity combine to produce a heat index that could cause health concerns for humans, the National Weather Service will issue various statements on heat conditions. For example, the NWS issues “Heat Advisories” when it expects the daytime heat index to equal or exceed 105° for 3 hours or more and the nighttime heat index equals or exceeds 80° for any 24-hour period. The NWS issues “Excessive Heat Warnings” when it expects the daytime heat index to equal or exceed 115° for 3 hours or more and the nighttime heat index equals or exceeds 80° for any 24-hour period. The NWS may issue an "Excessive Heat Watch" 24 to 8 hours in advance of heat wave conditions.

Currently, St. Croix County Emergency Management distributes educational information via local media on steps to minimize the impacts of extreme heat. In addition, the St. Croix County Aging Office also distributes similar education information through its newsletter to the County’s elderly; and its meal delivery personnel help maintain watch over elderly who might be more at-risk of succumbing to the impacts of extreme heat.

While extreme heat is a concern for the residents of St. Croix County, serious injury and fatalities are very uncommon. The Steering Committee recognized the risks and vulnerabilities of extreme heat to local residents, but believed current mitigation efforts were adequate to

address these concerns and the risks were not significant enough to warrant a full analysis. However, the effects of drought on agricultural operations, potentially in concert with extreme heat, are discussed in additional detail within the drought hazard assessment later in this report.

iv. Possible Impacts of Climate Change

Before analyzing each of the above eight hazards in detail, it should be considered that the risk and vulnerability assessment in this Plan is largely based on past weather events and existing development trends. However, projecting future risks is subject to the influence of possible large-scale, longer-term climatic changes.

There is ongoing debate over the existence, causes, severity, and impacts of global climatic changes, such as global warming. According to the U.S. Environmental Protection Agency:

> "According to the National Academy of Sciences, the Earth's surface temperature has risen by about 1 degree Fahrenheit in the past century, with accelerated warming during the past two decades. There is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities.... Rising global temperatures are expected to raise sea level, and change precipitation and other local climate conditions. Changing regional climate could alter forests, crop yields, and water supplies. It could also affect human health, animals, and many types of ecosystems.... Most of the United States is expected to warm, although sulfates may limit warming in some areas. Scientists currently are unable to determine which parts of the United States will become wetter or drier, but there is likely to be an overall trend toward increased precipitation and evaporation, more intense rainstorms, and drier soils."[10]

It is clear that some change in climatic trends has been occurring over the past 20 to 30 years. Global mean surface temperatures have increased 0.5-1.0°F since the late 19th century. The 20th century's 10 warmest years all occurred in the last 15 years of the century. Of these, 1998 was the warmest year on record. The snow cover in the Northern Hemisphere and floating ice in the Arctic Ocean have decreased. Globally, sea level has risen 4-8 inches over the past century. Worldwide precipitation over land has increased by about one percent. The frequency of extreme rainfall events has increased throughout much of the United States.

Projecting climatic changes for regions and smaller areas, such as St. Croix County, is even more difficult. Perhaps the most publicized analysis of the impacts of climate change within Wisconsin is from *Confronting Climate Change in the Great Lakes Region* published in April 2003 by the Union of Concerned Scientists and the Ecological Society of America. Experts from the University of Wisconsin participated in the development of the report and the related document which summarizes those impacts specific to the State of Wisconsin. This report provides the following findings for the State of Wisconsin:

- By the end of the 21st Century, temperatures will rise by 6-11°F in winter and 8-18°F in summer. Extreme heat will be more common, and the growing season could be 4-7 weeks longer. By 2080-2100, Wisconsin may experience up to 20 days annually with temperatures exceeding 97°F.

[10] U.S. Environmental Protection Agency. http://yosemite.epa.gov/oar/globalwarming.nsf/content/impacts.html

- Average annual precipitation may not change much, but the State will grow drier due to increased evaporation as a result of the warmer temperatures. Winter precipitation will likely increase 15-30% while summer precipitation will decrease up to 20%. More droughts are possible, and surface water levels would decline. Water quality and quantity concerns may increase, while related wildlife habitat (e.g., wetlands) may decrease. Demands on existing water supplies would increase.
- The frequency of heavy rainstorms will continue to increase, and could be 50-100% higher than today. Flooding and stormwater erosion would be expected to increase.
- By 2030, summers in Wisconsin may resemble those in Illinois overall, in terms of temperature and rainfall. By 2100, the summer climate will generally resemble that of current-day Arkansas, and the winter will feel much like current-day Iowa.

Confronting Climate Change in the Great Lakes Region—Impacts on Wisconsin Communities and Ecosystems provides three basic strategies to help reduce the potential impacts from climate change:

- Reducing heat-trapping gas emissions by increasing energy efficiency in buildings, investing even more heavily in renewable energy, and enhancing clean transportation choices.
- Minimizing pressures on the environment by improving air quality, protecting the quality and supply of water resources, protecting habitat, and limiting sprawl.
- Preparing for those impacts from global warming that cannot be avoided through better planning and emergency preparedness, adaptations in agriculture and shipping, strengthening public health response, and adjusting infrastructure.

Regardless of the scientific debate, climatic change due to global warming poses real risks. The exact nature of these risks for St. Croix County remains uncertain. Given the ongoing debate in the scientific community, it is not appropriate to debate these risks within this document. However, St. Croix County officials and residents should remain aware that the hazard trends presented in this report may change in the future; and, in some cases, the frequency and magnitudes of disaster events may intensify. Communities and residents should keep informed on climate change research and use their best judgment as to the most appropriate response.

B. RISK AND VULNERABILITY ASSESSMENT

The risk and vulnerability assessment is intended to describe the frequency, severity, and probability of future occurrences of the selected hazards that could have an impact on St. Croix County. These hazard profiles attempt to historically describe the cause and characteristics of each hazard and how they have affected the County's population, infrastructure, and environment, and the potential risk of the existing (or planned) property, improvements, and population to each of the hazards.

Although the assessment will attempt to focus on the risk potential to the overall community, critical facilities are of particular concern. These entities provide essential products and services to the general public that are necessary to preserve the welfare and quality of life in the community and fulfill important public safety, emergency response, and/or disaster recovery functions. The critical facilities have been identified in **Section II.E.** of the Plan.

A profile of each hazard discussed in this Plan is provided in each individual hazard section. For the purposes of this Plan, some hazards have been grouped into logically related hazard topics in order to better organize and describe the extent of the potential risk and vulnerability. With the exception of flooding, and perhaps hazardous materials incidents, these hazards do not have defined hazard areas; and events often affect large areas, or are even County-wide, such as drought, pandemic flu, or winter storm events. Most of these other hazards also lack of specific locational data for most historic events and, therefore, cannot be mapped.

Regional trends data in this section was in large part taken from the *State of Wisconsin Hazard Mitigation Plan* prepared by Wisconsin Emergency Management in 2004. Local data was largely taken from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) database and supplemented by the 2005 *St. Croix County Hazard Analysis*. More specific information on risks and vulnerabilities for the different hazard types come from a variety of sources, such as the FEMA National Flood Insurance Program and through interviews with key stakeholders and communities.

i. Tornadoes & High Winds

Risk Assessment—Tornadoes & High Winds

The Hazard

Tornadoes are relatively short-lived local storms composed of an intense rotating column of air, extending from a thunderstorm cloud system. It is nearly always visible as a funnel, although its lower end does not necessarily touch the ground. Average winds in a tornado, although never accurately measured, are between 100 and 200 miles per hour; however, some tornadoes may have winds exceeding 300 miles per hour. For standardization, the following are National Weather Service definitions of tornado and associated terms:

Tornado - A violently rotating column of air that is touching the ground.

Funnel Cloud - A rapidly rotating column of air that does not touch the ground.

A tornado path averages four miles, but may reach up to 100 miles in length. Widths average 300 to 400 yards, but tornadoes have cut swaths a mile or more in width, with severe tornadoes or groups of two or three funnels traveling together. On the average, tornadoes move between 25 and 45 miles per hour, but speeds over land of up to 70 mph have been reported. Tornadoes rarely last more than a couple of minutes over a single spot or more than 15 to 20 minutes in a ten-mile area, but their short periods of existence do not limit their devastation of an area.

The destructive power of the tornado results primarily from its high wind velocities and sudden changes in pressure. Wind and pressure differentials probably account for 90 percent of tornado-caused damage. Since tornadoes are generally associated with severe storm systems, hail, torrential rain and intense lightning usually also accompany them. Depending on their intensity, tornadoes can uproot trees, down power lines, and destroy buildings. Flying debris can cause serious injury and death.

High winds are analyzed within this section due to the potential similarities in impacts compared to a tornado, though high winds can form and occur under very different circumstances. High winds are those winds of 58 miles per hour or greater. High winds can affect much larger areas than a tornado and occur for a longer period of time. More intense types of high winds are downbursts or straight-line winds.

Downbursts, often referred to straight-line winds, are unrelated to tornadoes, but can have similar impacts and destructive power. A downburst is a strong downdraft, initiated by a thunderstorm, which induces an outburst of straight-line winds on or near the ground. They may last anywhere from a few minutes in a small scale microburst to periods of up to 20 minutes or longer, known as a macro-burst. Wind speeds in downbursts can reach 150 mph.

Downburst damage is often highly localized and resembles that of tornadoes. There are significant interactions between tornadoes and downbursts, and a tornado's path can also be affected by downbursts. Because of this, the path of a tornado can be very unpredictable. High

winds, including straight-line winds, are discussed as part of the risk and vulnerability assessment for tornadoes.

Shown in **Table 17** is the Fujita Scale, recognized as the accepted tornado magnitude measurement rating.

TABLE 17. Tornado Magnitude Measurement Fujita Scale

F-Scale	Wind Speed (miles per hour)	Character of Damage	Relative Frequency (percent)
F0 (WEAK)	40-72	Light Damage	29
F1 (WEAK)	73-112	Moderate Damage	40
F2 (STRONG)	113-157	Considerable Damage	24
F3 (STRONG)	158-206	Severe Damage	6
F4 (VIOLENT)	207-260	Devastating damage	2
F5 (VIOLENT)	261-318	Incredible damage (rare)	<1

Source: National Oceanic Atmospheric Administration (NOAA)

The following types of damage could be expected for each F-Scale tornado:

F0 Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.

F1 The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.

F2 Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.

F3 Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted.

F4 Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

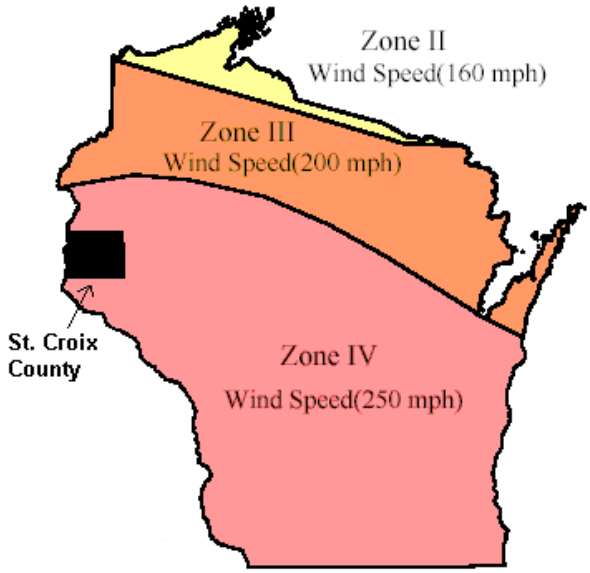
F5 Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile-sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

Regional Trends

On the basis of 40 years of tornado history and more than 100 years of hurricane history, the United States has been divided into four zones that geographically reflect the number and strength of extreme windstorms. Zone IV has experienced the most frequent and the strongest tornado activity with wind speeds of up to 250 mph, and includes all of St. Croix County (see **Figure 11**).

Wisconsin lies along the northern edge of the nation's maximum frequency belt for tornadoes (known as "tornado alley") which extends northeastward from Oklahoma into Iowa and then across to Michigan and Ohio. Generally, the frequency and severity of tornado events decreases as one travels north.

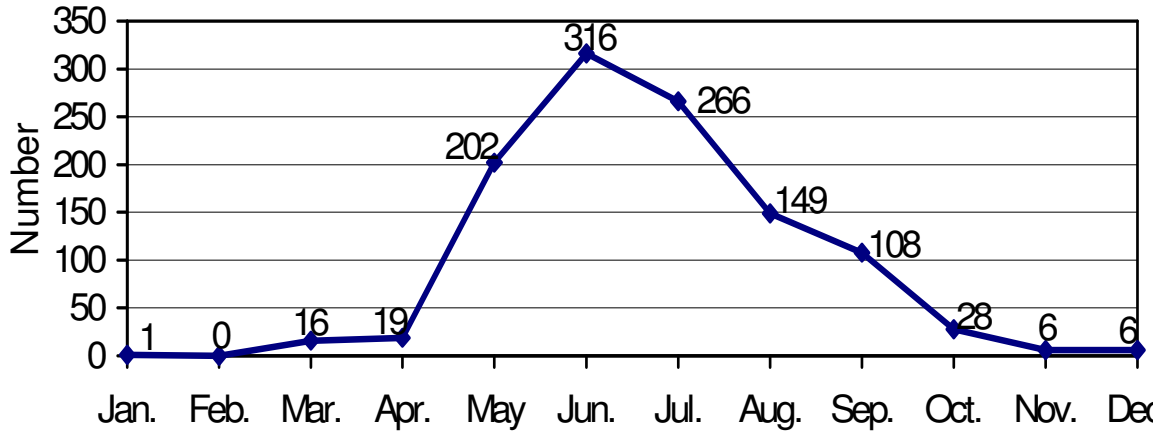
FIGURE 11. Design Wind Speed Map of Wisconsin



adapted from "Design Wind Speed" map from FEMA's "Taking Shelter from the Storms: Building a Saferoom in Your House"

Tornadoes have occurred in Wisconsin in every month except February, as shown in **Figure 12**.

FIGURE 12. Tornado Events by Month • 1844 to 2001 State of Wisconsin



Wisconsin's tornado season runs from the beginning of April through September. The most severe tornadoes typically occur during April, May, and June. Many tornadoes strike in late afternoon or early evening. However, tornadoes have occurred during other times of the day. Such tornado events for central and northern Wisconsin (including St. Croix County) are less frequent, with 1-5 such events recorded per 1,000 square miles on average, when compared to the southern portion of the state.[11]

[11] FEMA. Taking Shelter from the Storm. <http://www.fema.gov/pdf/library/2ismsec1.pdf>. p.3.

Personal property damage, deaths, and injuries have and will continue to occur in Wisconsin as a result of tornadoes. The potential destructiveness of tornadoes remains fresh in the minds of many residents of west-central Wisconsin due to two recent and substantial tornado events in the region. On June 18, 2001, an F3 tornado with a 27-mile path hit the Village of Siren approximately 40 miles to the north, resulting in three deaths, 16 injuries, 167 destroyed homes, and 280 damaged homes. More recently, 55 miles northeast of St. Croix County, an F3 tornado hit the City of Ladysmith on September 2, 2002, injuring 37 and resulting in over $20 million in damage. Many long-time residents of the County and region also recall the devastating Colfax Tornado of 1958 which had a 32-mile path, caused at least 19 deaths, and resulted in severe damage. But for St. Croix County, and in particular the residents of the New Richmond area, a single tornado event over a hundred years ago remains a large part of local history.

1899 New Richmond Tornado

On June 12, 1899, the City of New Richmond had about 2,500 residents in addition to hundreds of tourists who had come to town to see the Gollmar Brothers Circus. After a harsh and cold winter, residents were enjoying the very warm day which was sunny for most of the afternoon. At about 4:30 P.M., a heavy rain with some hail fell, driving people temporarily indoors. But after the circus ended and the rain let up, people began to head home for the day. At 6:00 P.M., the streets were full of tourists, travelers, and residents.

Unknown to them, approximately 30 minutes earlier, a waterspout was seen on Lake St. Croix about 15 miles southwest of New Richmond. As the waterspout moved northeast and reached land, it became a tornado which destroyed farm buildings and killed three people in its path.

The tornado reached New Richmond about 6:00 P.M. with little or no warning. Many people took shelter in a dry goods store which was swept away and those in the shelter were pelted to death by flying bricks and timbers. Many outside were also killed from flying debris or were picked up and thrown. A 3,000 pound safe was later found a block from its original location.

Ruins of the New Richmond Methodist Church, 1899.

The Milwaukee Journal at that time estimated more than 500 structures were destroyed, most totally splintered and torn from their foundations, though another damage estimate states 230 buildings were destroyed. Regardless of the estimate, the entire City, except the extreme west end, was in ruins. Residents were unable to fight resulting fires since the water facilities were gone. According to one

observer, the fire was the "saddest and most horrible part of the whole affair." Messengers had to be used to request medical supplies and emergency assistance since telegraph and telecommunication lines had also been destroyed. And as night fell, rescuers worked by the light of the fires as they searched for those trapped, the injured, and the dead since the city's electrical power service was also in ruins. Many of the bodies found were burned beyond recognition and, in some cases, it was impossible to determine if the actual cause of death was directly due to the tornado or from the ensuing flames.

Official estimates determined that 117 people had been killed (114 within the city) and more than 200 injured, making the New Richmond tornado the eighth deadliest in U.S. history and the worst in Wisconsin history. Twenty-six families lost more than one individual, while six reported four or more deaths in the family. Over 400 animals were also killed. More than $600,000 (over $13 million in 2005 dollars) in damage claims were made, though it was believed that many people did not file claims, moved elsewhere, or there was no one left in the household to file a claim.

Despite these losses, most of the residents looked to the future; and the rebuilding process began promptly. Within five months' time, an estimated 100 new buildings had already been completed. After a temporary post office was set up, postal officials in Washington D.C., who were unaware of the tornado, demanded to know who had authorized a change in location for a federal building. It is reported that New Richmond's postmaster replied, "God Almighty." Today, the disaster and those lost are memorialized at Cyclone Memorial Park located on the west side of State Highway 65 South near the technical college in New Richmond.

Additional Local Tornado Events

St. Croix County has had numerous additional tornadoes of varying degrees of magnitude and severity during the past fifty years. Shown in **Table 18** is a listing of tornadoes that have been reported for St. Croix County since 1951.

The National Climatic Data Center database does not include historical tornado events prior to 1950. Only recently, since 1986, have funnel clouds which have not touched the ground been reported in the database, though it is highly likely that many of these continue to go unreported. Tornado event data prior to 1970 appears sporadic and seems to indicate that the frequency of tornado events is on the rise, but this is not necessarily true; data in recent decades is much more robust as the number of reported events increase. As such, the risk analysis should focus primarily on those events occurring in recent years.

From 1970 to 2005, twelve unrelated tornado events of varying magnitude and severity have been reported for St. Croix County. This averages one tornado approximately every 2.9 years ,based on recent event reports. Four additional funnel cloud events were also reported between 1986 and 2005, with a funnel cloud event reported every 4.8 years, based on these recent reports.

The 27 tornado events reported in Table 18 resulted in 2 deaths, 35 injuries, and at least $204 million of estimated property damage in current dollars. However, 80% of this property damage and the majority of the reported injuries were the result of a single event in June 1958, commonly referred to as the "Colfax Tornado," once the dollar amount has been adjusted for inflation. Based on the NCDC data, tornadoes in St. Croix County have resulted in approximately $9,717,702 in reported damages per event on average for the 21individual tornado

events over the past 50 years. Some reported tornado events have resulted in no damage, while the June 1958 event resulted in $164 million in damages. Most tornado events occur with no deaths and minor, if any, injuries; but death and injuries have occurred during the higher magnitude events. Depending on the location and magnitude of future tornado events in the St. Croix County, additional deaths, injuries, and destruction of property could be very likely.

But it is important to keep in mind that data reports can vary significantly. For instance, Wisconsin Historical Society information estimates only $43.7 million in property damage (*adjusted for inflation*) for the entire path of the June 1958 tornado which has been estimated at 32 miles long and up to 800 feet wide. Other events can go unreported to the National Weather Service and do not appear in the NCDC database. As an example, the NCDC data does not include damage for the July 1982 tornado or straight-line wind event discussed in the 2005 *St. Croix County Hazard Analysis* which ripped through the Wall Street Trailer Court in the Town of Star Prairie, destroying 61 out of 66 mobile homes.

TABLE 18. Tornado Events • 1951 – 2005
St. Croix County

Location or County	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
St. Croix County	5/10/1953	06:35 PM	Tornado	F2	1	9	$17,400,013	$0
St. Croix County	8/15/1954	06:00 PM	Tornado	F2	0	0	$1,726,192	$0
St. Croix County	5/24/1958	02:45 PM	Tornado	F3	0	6	$1,639,977	$0
St. Croix County	6/4/1958	05:30 PM	Tornado	F5	1	20	$163,997,735	$0
St. Croix County	6/22/1958	03:25 PM	Tornado	F0	0	0	$0	$0
St. Croix County	10/9/1958	12:00 PM	Tornado	F2	0	0	$163,998	$0
St. Croix County	9/2/1961	09:30 PM	Tornado	F1	0	0	$18,711	$0
St. Croix County	7/28/1964	07:00 AM	Tornado	F1	0	0	$18,107	$0
St. Croix County	7/3/1966	05:30 PM	Tornado	F0	0	0	$146,464	$0
St. Croix County	6/4/1971	07:40 PM	Tornado	F1	0	0	$118,931	$0
St. Croix County	6/12/1976	05:00 PM	Tornado	F2	0	0	$85,830	$0
St. Croix County	7/30/1977	05:20 PM	Tornado	F3	0	0	$8,112,452	$0
St. Croix County	7/15/1980	08:45 PM	Tornado	F2	0	0	$6,349,147	$0
St. Croix County	7/24/1981	05:35 PM	Tornado	F0	0	0	$55,940	$0
St. Croix County	8/7/1984	06:30 PM	Tornado	F0	0	0	$0	$0
St. Croix County	5/29/1987	02:53 PM	Tornado	F0	0	0	$0	$0
St. Croix County	7/6/1987	03:08 PM	Tornado	F0	0	0	$0	$0
Woodville	5/30/1994	04:35 PM	Tornado	F1	0	0	$638,259	$63,826
River Falls	8/23/1997	06:05 PM	Funnel Cloud	N/A	0	0	$0	$0
Somerset	6/5/1999	03:40 PM	Tornado	F0	0	0	$0	$0
River Falls	7/26/2000	11:40 AM	Funnel Cloud	N/A	0	0	$0	$0
Hudson	7/26/2000	12:02 PM	Tornado	F0	0	0	$0	$0
Wilson	9/5/2004	06:28 PM	Funnel Cloud	N/A	0	0	$0	$0
Emerald	6/11/2005	01:20 PM	Tornado	F0	0	0	$0	$0
Hammond	6/11/2005	02:04 PM	Tornado	F1	0	0	$3,600,000	$0
Cylon	6/11/2005	02:43 PM	Tornado	F0	0	0	$0	$0
Roberts	6/11/2005	06:18 PM	Funnel Cloud	N/A	0	0	$0	$0
Totals:	27				2	35	$204,071,756	$63,826

Source: St. Croix County Hazard Analysis, 2005; National Climatic Data Center (NCDC) 1950-Summer 2005
Damage estimates in current dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

All but one of the tornadoes in Table 18 occurred during the months of May through September. A majority of the events occurred between the hours of 2:00 PM and 7:00 PM, with only two tornados reported for the morning hours. For those events where a magnitude was identified, only three tornadoes were reported as exceeding an F2 magnitude, the most recent in 1977.

Based on available recent data, it is expected that one tornado event will continue to be reported for St. Croix County every 2 to 3 years on average, with an occasional funnel cloud reported more frequently as weather reporting improves. Additional tornado events are likely, but these events may go unreported in instances where contact with the ground is not made or the event occurs at night without visual confirmation.

It is challenging to analyze local high wind event trends since most high wind events are reported to the NCDC as part of thunderstorm events. The NCDC event data also does not necessarily distinguish general high wind events from the more intense and potentially destructive downbursts. Damages or disaster declarations are reported by storm; and historical records most often do not distinguish which physical component of a given storm (e.g., wind, hail, heavy rain, flash flooding) may have been the primary cause of the damage. Given these challenges, the NCDC data for high wind events is reviewed as part of the thunderstorm assessment in the next section.

7/26/2000 funnel cloud near River Falls

In general, of the 159 thunderstorm-related event reports, 97 (or 61%) included high winds. Between 1980 and 2005, an average of 3.68 high wind events, typically associated with thunderstorms, were reported annually. Based on recent reported high wind events, it is estimated that 3 to 4 high wind events (typically as part of a thunderstorm) will continue to occur annually within St. Croix County. The far majority of high wind events have occurred with no reported damage. Property or crop damage was only reported for ten of the 97 wind events, with an average of $88,618 in damage reported per event. Further, no deaths and only three injuries related to high winds have been reported.

Crop losses often go under-reported or unreported in the NCDC database as well. According to discussions with local Farm Services Agency and UW-Extension officials, tornadoes and high winds have likely been the largest cause of crop damages in St. Croix County in the past, especially to corn and beans. However, data is not readily available to confirm this anecdotal testimony. This may be surprising to some since drought, frost, and flooding often first come to mind as the most significant natural disaster-related causes of crop damage.

The destructive impacts of thunderstorms with downbursts or high, straight-line winds are at times difficult to distinguish from the concentrated cyclical winds of a tornado, especially at night when visual confirmation may not be possible. Some regional debate continues on whether the damage from one recent event was the result of high, straight-line winds (as officially recorded) or tornadoes. Further, tornado and thunderstorm/high wind events are very often related and part of the same storm cell, making it a challenge to distinguish the impacts.

Relative Level of Risk

As the hazard risk assessment survey reflects (see Table 14), tornadoes and associated high winds were ranked by the Steering Committee as the highest overall hazard concern for St. Croix County. Even so, the risk survey average for tornadoes and high winds was still moderate-to-high (3.67), reflecting that tornado events are not the most frequently occurring hazard in the County. However, tornadoes were ranked as potentially having the highest overall impact to persons, property, and other assets when these events do occur in St. Croix County, with a vulnerability ranking significantly higher than most other hazards at 4.00. Only pandemic flu was ranked as potentially having a higher vulnerability impact with an averaging ranking of 4.11.

This score in large part reflects the 1899 New Richmond Tornado, the 1958 Colfax Tornado, and the recent 2005 "Hammond Tornado," but may also reflect the awareness of potential tornado impacts given the two fairly recent devastating tornado events in nearby Wisconsin communities outside St. Croix County--Siren and Ladysmith. These tornado events were mentioned numerous times during community meetings and key-informant interviews.

Vulnerability Assessment – Tornadoes & High Winds

Potential Impacts

Tornadoes and high winds have no defined hazard area within St. Croix County and may occur in any part of the county. Due to the unpredictable nature of tornadoes and lack of specific hazard areas, the assessment of potential community impacts as a result of a tornado is difficult to quantify.

Tornadoes are capable of killing or injuring residents and damaging or destroying homes, businesses, public buildings and infrastructure. This destruction can occur as a result of the high winds or by airborne debris that can be carried by the tornado. Tornadoes can uproot trees and topple power lines, impacting the supply of electrical service to local homes and businesses. Roadways can also be blocked by debris, and debris can accumulate in rivers or stormwater systems and contribute to washouts or flooding.

All above-ground structures are vulnerable to a tornado or straight-line wind event. As discussed previously, St. Croix County has over $4.9 billion in assessed improvements and additional assessed personal property most, if not all, of which could be vulnerable to such events. And this total does not include those structures which are located on the 23,397 tax-exempt acres in the County (e.g., municipal buildings, churches, certain utilities).

Further, damaged buildings may pose additional safety concerns due to structural instability, damage to electrical systems, or gas leaks. It is unfeasible at this time for the County to maintain a database which accurately details the structural condition of all $4.9+ billion in assessed improvements in St. Croix County to determine which structures may be more vulnerable to the impacts of future tornado events.

In addition to the direct impacts on structures, economic losses can be experienced when a business sustains direct damage from the event or when supporting infrastructure (e.g., utilities, services) are not available for extended periods. Such a business closure may be temporary, but

could have large impacts on the local economy and related services, while some smaller or struggling business may fail.

Based on a review of the community and past tornado impacts, it was determined that the following general types of properties are especially vulnerable to tornado and high wind events:

- mobile homes, especially those which are unanchored
- homes with crawlspaces (elevated and more susceptible to lift)
- buildings with large spans (e.g., airport hangars, pole barns, gyms, factories)
- above-ground utilities, such as power lines and telephone lines
- large events and structures with large numbers of people
- other critical facilities and historic sites, due to their value to the community

Mobile homes, in particular, are vulnerable to tornado events. According to the National Weather Service, between 1995 and 2002, there were 415 tornado fatalities in the United States. Forty-one percent (41%) of these fatalities occurred in mobile homes, which constitute just 7.5% of the nation's housing supply.

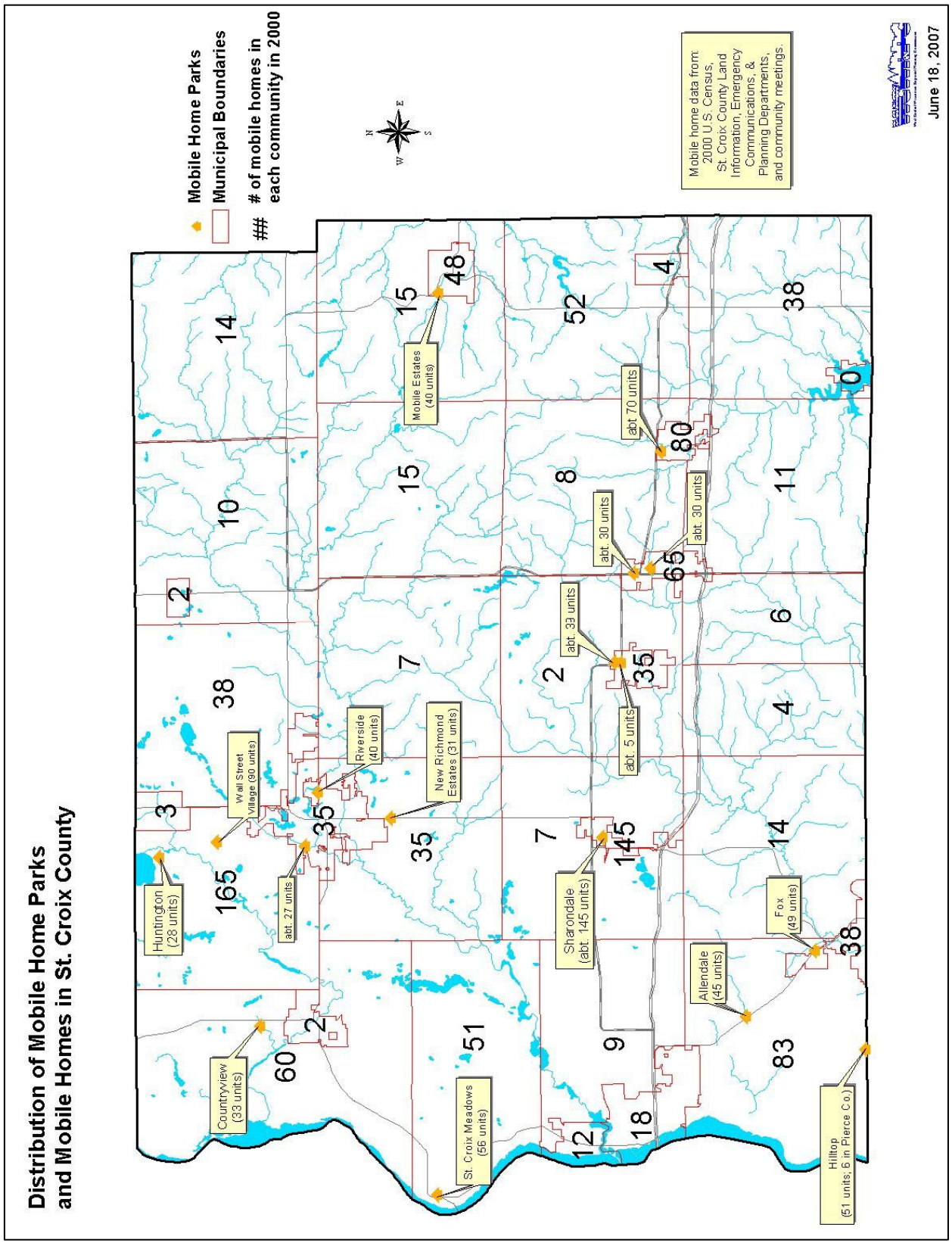
As reviewed previously, a total of 1,131 housing units (4.7% of all units) in St. Croix County were mobile homes in 2000, very comparable to the State of Wisconsin average of 4.4%. Approximately 14.6% (or 165) of these mobile homes in 2000 were located within the Town of Star Prairie, and 12.8% (or 145) were located in the Village of Roberts. 57% of the mobile homes are located in unincorporated towns and most are likely out of range of weather warning sirens. According to the 2000 Census, a total of 2,581 citizens were residing in a mobile home, for an average household size of 2.36 persons per occupied mobile home housing unit.

A number of communities in the western portions of the County noted that high land prices has discouraged the installation of new mobile homes. While a few mobile home parks have constructed a shelter on site or have agreements in place for a nearby shelter, most mobile home parks in the County are believed not to have convenient access to a dedicated or public shelter. In a few cases, a potential shelter is presumed to be available, but there is no formal agreements or procedures in place, or the shelter may not be available at all times.

Shown in **Figure 13** on the following page is the distribution of the ten mobile home parks in St. Croix County, along with the number of mobile homes in each jurisdiction. Of the seventeen mobile home parks identified during the planning process, seven were located in unincorporated areas. Most of these may be outside of the range of sirens for weather warnings and likely do not have convenient, quick access to structures with a storm shelter. Figure 13 also reflects the large numbers of mobile homes located in the unincorporated Towns of Star Prairie, Troy, and Somerset, as well as in the Villages of Roberts, Baldwin, and Woodville.

Structural data for all buildings in St. Croix County is limited. No countywide database or housing census is available which identifies the number of homes with crawlspaces or the location of large-span structures in the County. Approximately 15% of the County's housing units were built in 1939 or earlier, with 44% of the housing units being built since 1990.

FIGURE 13. Location of Mobile Home Parks in St. Croix County



The *State of Wisconsin Hazard Mitigation Plan* provides county loss estimates for tornado and straight-line wind damage to homes based on FEMA's Hurricane Wind Benefit Cost-Analysis Module and using the Census and FEMA's HAZUS natural hazard loss estimate methodology. The tornado and high straight-line wind loss estimates in **Table 19** for St. Croix County are taken from the *State Hazard Mitigation Plan*.

TABLE 19. St. Croix County Tornado & Straight-Line Wind Loss Estimates for Residential Units

Tornado Loss Estimates	Total Annual Damage	Total Future Risk (30 years)
Manufactured Housing	$777,556	$9,649,464
Non-Engineered Wood Frame	$11,344,353	$140,783,418
Combined	$12,121,908	$150,432,882
Structural & Contents	$198,075	$2,458,111
Injury & Mortality	$11,923,834	$147,974,784
Combined	$12,121,909	$150,432,895
Straight-Line Wind Loss Estimates	**Total Annual Damage**	**Total Future Risk (30 years)**
Manufactured Housing	$701,754	$8,708,767
Non-Engineered Wood Frame	$19,591,684	$243,132,802
Combined	$20,048,775	$248,805,304
Structural & Contents	$18,482,233	$229,364,517
Injury & Mortality	$1,566,543	$19,440,779
Combined	$20,048,776	$248,805,316

Source: Wisconsin Emergency Management. *State of Wisconsin Hazard Mitigation Plan*. October 2004.
Note: Some minor variations appear above due to rounding.

The methodology used to develop the above loss estimates is described in the *State of Wisconsin Hazard Mitigation Plan*. It incorporates annual probabilities and average area of impact for varying degrees of the Fujita Scale or wind speeds, and the percent of damage by building type. For instance, there is a 0.002368% probability of any area in Wisconsin being impacted by a Class F2 tornado in any given year which would cause 75% damage to a manufactured home, 50% damage to a non-engineered wood frame home, and 25% damage to a fully-engineered home. Contents of the structure were calculated at 30% of the value of the structure.

Injury and mortality calculations also considered the probability by wind speed or tornado class, occupancy rates, and building-type. For instance, death could be expected for 75% of manufactured housing residents which experience a F3 tornado, but no deaths could be expected for a F1 or weaker tornado. On average, injuries were given a monetary value of $7,500 per injury, while deaths were given a monetary value of $3,000,000 per death.

Average total losses from tornado events in St. Croix County can be estimated at just over $12.1 million annually, with the understanding that damages may not incurred every year. Average annual straight-line wind losses were significantly higher at $20 million per year. A substantial difference between these two hazard types is that almost 98% of the estimated tornado damages are from injuries and deaths, while, conversely, only 8% of the estimated straight-line wind

damages are related to injuries or deaths. This discrepancy is in large part due to rarity of deaths associated with the windstorms, though high straight-line winds typically affect larger areas which can cause substantial structural damage.

It should also be noted that roughly 6.4% of the estimated annual tornado damages occur to manufactured homes and their residents, even though these homes have a considerably lower average value and only represent 4.8% of the County's total housing stock. Overall, St. Croix County ranked 23rd among Wisconsin's 72 counties for annual tornado damage risk based upon the above loss estimates.

While few, if any, buildings can withstand the direct impact of a large-magnitude tornado, large-span structures are most vulnerable to high wind damage. Data on the number of large-span structures in St. Croix County is not available, though some, such as school gymnasiums, are addressed in the critical facilities vulnerability assessment. Most of these large-span buildings tend to be large storage buildings, garages, or barns which are common throughout the County. Many of these are relatively inexpensive to construct and are used for storage or livestock.

Of greater vulnerability, due to contents and risk of injury or death, are industries or big-box commercial buildings which have large-span structures. Most of these are located near or within the Cities of Hudson, New Richmond, and River Falls.

Large events and facilities which hold large numbers of people also pose significant vulnerabilities. This can include activities such as concerts and tubing near Somerset and events at the County Fairgrounds in Glenwood City.

Camping is available for up to 61 families is available at the County's Glen Hills Park Campground which has an emergency response plan specific to the park. A weather radio is monitored by on-site Park staff from 8 AM to 12 AM to alert campers, should it be needed. A large block shower building and the basement of a nearby golf course building are available for use as shelters.

Although the improvement of technology has enabled meteorologists to better identify and predict the conditions that are favorable for tornado development, there is no precise way to predict the formation, location, and magnitude of a tornado. And, as shown previously, there is no predictable pattern that can be used to anticipate future tornado events and their impacts. It is also sometimes difficult to distinguish between the damage caused by tornadoes and that of the hail, high winds, and thunderstorms which often accompany this hazard.

Additional property and crop damage due to high winds is very likely in the future, along with the potential for injury or death. In addition, the continuing changes in land-use and development patterns can influence the County's potential for future exposure to tornadoes. As discussed previously, St. Croix County is continuing to grow and develop. This creates an increasing exposure based on the number of residents and properties that could be at risk from future tornado events.

There are no natural areas or environmental characteristics within St. Croix County which are uniquely vulnerable to tornadoes or high winds.

Vulnerable Critical Facilities

All critical facilities are susceptible to being hit by a tornado. A complete assessment of the community's assets (critical facilities) and their susceptibility to tornadoes and other hazard events is located in **Appendix F**.

Though none of the critical facilities has historically been impacted by tornadoes in recent years, the vulnerability assessment did yield that tornadoes represent the highest vulnerability and risk to the critical facilities of St. Croix County. Schools were of special concern due to:

- they often have large numbers of individuals present, including school-age children. or when being used as a storm shelter in some communities
- most schools have large span areas, such as gyms and theaters, which are especially vulnerable to tornadoes and high winds

Utilities and infrastructure, especially above-ground power and communication lines, were also rated as having a high vulnerability. Such poles, lines, and towers could either be directly harmed by the tornado; or adjacent trees can fall on lines, taking them down.

Vulnerabilities Related to Electric Power Loss

The loss of electric power may be caused by many different types of disaster events, so this brief analysis might also have been included in the winter storms, thunderstorms, and flooding sections. Tornadoes may directly damage substations and power lines. High winds, ice, snow, and flooding may take down poles or topple trees or branches onto power lines. Lightning strikes may cause equipment failure. Poor road conditions due to weather conditions increase the potential for vehicles striking power poles. And while the potential risk may be low, the loss of a substation due to terrorism or vandalism could have very substantial consequences.

Power outages can be even more challenging should they occur in conjunction with extreme heat, cold, or flooding conditions. Heating, cooling, lighting, and communication equipment may all be inoperable, leading to damage or threatening the health of residents. Sump pumps may not be available to remove flood water. Home medical equipment may not be operational. As more residents turn to candles, oil lamps, and burning wood for light and heat, the threat of fire increases.

Large losses of confined livestock have occurred in other counties due to the loss of power to fans during an extreme heat event. This could be a concern to the significant number of turkey farms in the County. And dairy farms rely on electrical power for water supply and milking operations. It has been estimated that less than 50% of the smaller producers in the County have power generators should the need arise.

Xcel Energy provides electric power to most of the incorporated areas of the County and some of the adjacent rural areas. St. Croix Energy Cooperative is the largest electric provider in the County and receives special attention within this plan since they are eligible for FEMA disaster and mitigation dollars as a non-profit utility.

St. Croix Energy Cooperative serves approximately 75% of the land area of St. Croix County with roughly 800 miles of aboveground electric power lines. For all power outages from 1998 to 2006, trees falling on power lines were the largest single source of outages and lost customer

lines. Approximately 36% of their total lost customer hours during this timeframe were due to trees falling on overhead power lines, with high winds being the likely biggest contributing factor.

Through tree-trimming programs, electric providers work to mitigate these potential outages. In addition, approximately 50% of the Cooperative's power lines are buried which further mitigates potential storm impacts. But there are some wooded areas with shallow depth to bedrock, such as along the St. Croix River in the Town of Troy, which makes it difficult or financially unfeasible to bury power lines. No other areas were specifically identified as being prone to potential outages. Of note, the North Hudson area is currently provided service through a single substation which raises concern of dependability should that substation be damaged.

The Cooperative does have some areas of older line with smaller-diameter construction which is more prone to breakage due to contracting during extreme cold or from lightning. Though the replacement of these lines remains on the Cooperative's list of priorities, the pace of growth and development in the County in recent years has not allowed the Cooperative to perform this costly replacement.

Unique Jurisdictional Risks or Vulnerabilities—Tornadoes

Tornadoes pose no risks or vulnerabilities unique to individual incorporated jurisdictions (*villages and cities*). Overall, the level of vulnerability increases with development density, population density, type of development, and value of improvements. And as more growth and development occur, this vulnerability also increases. As such, cities and villages are the highest vulnerability areas, as well as those areas with higher populations, larger numbers of housing units, and higher assessed value per square mile described previously in **Sections II.C. & D.** of the Community Profile.

During the planning process, each incorporated area was analyzed to provide insight into the extent of its vulnerabilities to tornadoes and extremely high wind events. These differences in vulnerability to tornado events are further discussed in the *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G**.

As mentioned previously, the City of New Richmond has had the most significant tornado event, with the 1899 tornado destroying most of the structures in the community. Some communities, such as the Village of Wilson, experienced the high winds associated with the 1958 Colfax tornado, but no incorporated area in St. Croix County was directly impacted by this tornado. More recently in 2005, a tornado struck the Village of Hammond, resulting in damages to about 38 homes, but injuries or deaths were avoided. Village officials report that there were numerous lessoned learned from this 2005 event which will further strengthen their response procedures if such an event should be repeated in the future.

All communities have mobile homes or parks, ranging from fewer than five in four communities to over 145 in the Village of Roberts. In fact, only about 32% of the existing mobile homes in St. Croix County are located in the incorporated cities and villages; the far majority of such homes are located in the unincorporated towns. There is little new mobile home park development occurring in most communities, especially in the west portions of the County where land prices are higher, which discourages such development. Some communities limit such

development to mobile home parks, while others prohibit mobile homes altogether. Most newer mobile homes are anchored or tied down, while many others are not. Many communities did note that new slab, on-grade construction of homes, condos, or apartments without basements or crawlspaces has become very popular.

Three somewhat unique risks from tornadoes or high winds were identified for the incorporated communities. The City of Glenwood City noted concerns with the County Fairgrounds which can have 2,000 to 3,000 visitors on any given day during the fair. During a recent storm warning, many fair-goers took shelter in nearby commercial establishments which was not entirely expected or wanted by some shop owners. While an emergency plan does exist for the Fairgrounds, some additional detail work and coordination on the plan could be beneficial. The Village of Somerset noted a similar concern with concerts and up to 15,000 recreational visitors in the area who are camping, fishing, inner-tubing, etc, on some summer days. A number of municipalities, such as the City of River Falls, noted the existence of some large-span industrial or commercial buildings which could also be more vulnerable during a tornado event.

As will be discussed later in the review of mitigation activities, numerous municipalities noted the lack of a community storm shelter for public use, with at least one (Village of Woodville) indicating a desire to consider such. In at least three communities, the demand for such a shelter may be low due to the availability of a basement at a nearby neighbor's or relative's home. In three other communities, a shelter is available, but no formal agreement or policy may exist requiring its use or it may only be available during certain hours. The City of New Richmond noted that a shelter is available, but it is underutilized. This generally demonstrates the need for continued educational efforts for County residents about the importance of taking shelter during a storm warning and making them aware of those shelters which might be available.

Many communities do not require mobile homes to be anchored or tied down, unless the mobile homes are newer and fall under more recent installation codes. Most communities also do not specifically require mobile home parks to have storm shelters or an emergency operating plan, though these are sometimes required as part of a conditional use permit. The Village of Hammond has used this approach to require a shelter as part of a recent permit approval for a mobile home park expansion, but construction of the shelter has not yet begun.

Many of the communities also stated a need for a new weather siren to replace aging equipment, additional weather siren coverage to accommodate areas of new residential growth, or siren battery back-up. The Village of Baldwin and the City of New Richmond both also mentioned that their airport hangers and the planes themselves are also at special risk during high wind events.

ii. Winter Storms and Extreme Cold (including blizzards and ice storms)

Risk Assessment—Winter Storms

The Hazard

Winter storms can vary in size and strength and include heavy snowstorms, blizzards, freezing rain, sleet, ice storms, and blowing and drifting snow conditions. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury such as frostbite and death.

A variety of weather phenomena and conditions can occur during winter storms. The following are National Weather Service-approved descriptions of winter storm elements:

Heavy Snowfall - the accumulation of six or more inches of snow in a 12-hour period, or eight or more inches in a 24-hour period.

Blizzard - the occurrence of sustained wind speeds in excess of 35 miles per hour accompanied by heavy snowfall or large amounts of blowing or drifting snow.

Ice Storm - an occurrence where rain falls from a warm and moist upper layer(s) of the atmosphere to colder and dryer layer(s) at or near the ground, freezes upon contact with the ground, and accumulates on exposed surfaces.

Freezing Drizzle/Freezing Rain - the effect of drizzle or rain freezing upon impact on objects that have a temperature of 32 degrees Fahrenheit or below.

Winter Storm - the occurrence of heavy snowfall accompanied by significant blowing snow, low wind chills, sleet or freezing rain. In this document, winter storms is used broadly and encompasses all of the hazards defined above.

Dangerously cold conditions can be the result of extremely cold temperatures or the combination of cold temperatures and high winds. The combination of cold temperature and wind creates a perceived temperature known as "wind chill."

Wind chill is the apparent temperature that describes the combined effect of wind and air temperatures on exposed skin. When wind blows across the skin, it removes the insulating layer of warm air adjacent to the skin. When all factors are the same, the faster the wind blows, the greater the heat loss, which results in a colder feeling. As winds increase, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature.

Shown in **Table 20** on the following page are the calculated wind chill temperatures as a result of particular air temperatures and wind speed.

TABLE 20. Wind Chill Table
(Wind Chill Values in Degrees Fahrenheit)

Temperature (°F)	Wind Speed (MPH)								
	5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**
30	25	21	19	17	16	15	14	13	12
25	19	15	13	11	9	8	7	6	5
20	13	9	6	4	3	1	0	-1	-2
15	7	3	0	-2	-4	-5	-7	-8	-9
10	1	-4	-7	-9	-11	-12	-14	-15	-16
5	-5	-10	-13	-15	-17	-19	-21	-22	-23
0	-11	-16	-19	-22	-24	-26	-27	-29	-30
-5	-16	-22	-26	-29	-31	-33	-34	-36	-37
-10	-22	-28	-32	-35	-37	-39	-41	-43	-44
-15	-28	-35	-39	-42	-44	-46	-48	-50	-51
-20	-34	-41	-45	-48	-51	-53	-55	-57	-58

Source: National Weather Service

Regional Trends

Generally, the winter storm season in Wisconsin runs from October through March. Severe winter weather has occurred, however, as early as September and as late as the latter half of April and into May in some locations.

Much of the snowfall in Wisconsin occurs in small amounts of between one and three inches per occurrence. Heavy snowfalls that produce at least eight to ten inches of accumulation happen on the average only five times per season. True blizzards are rare in Wisconsin. They are more likely to occur in northwestern Wisconsin than in southern portions of the state, even though heavy snowfalls are more frequent in the southeast. However, blizzard-like conditions often exist during heavy snowstorms when gusty winds cause the severe blowing and drifting of snow. The far northern portions of the State experience the greatest annual mean snowfall of over 160 inches, with St. Croix County having an average seasonal snowfall of 40-50 inches. The record for seasonal snowfall belongs to Hurley in far northern Wisconsin, which received 277.7" of snow over an 8-month period in the winter of 1996-7, far above their seasonal average of 160 inches. But the greatest snowfall recorded in Wisconsin in a single day occurred 75 miles south of St. Croix County at the Trempealeau Dam on January 20, 1952, when 25 inches fell within 24 hours.

Both ice and sleet storms can occur at any time throughout the winter season from October into April. Early- and late-season ice and sleet storms are generally restricted to northern Wisconsin. Otherwise, the majority of these storms during the winter months occur in southern Wisconsin. In a typical winter season, there are 3 to 5 freezing rain events; and a major ice storm occurs on a frequency of about once every other year. If a half-inch of rain freezes on trees and utility wires, extensive damage can occur, especially if accompanied by high winds that compound the effects of the added weight of the ice. There are also between three and five instances of glazing (less than 1/4 inch of ice) throughout the state during a normal winter.

One of the most devastating natural disasters in Wisconsin history was the ice storm which hit eastern and southern Wisconsin in March 1976. This incredible ice storm completely snapped hundreds of utility poles, downed thousands of power and telephone lines, and totally destroyed many trees. Some ice accumulations ranged up to a phenomenal five inches in diameter on wires and limbs of trees. High winds gusting to 60 mph made a horrible situation even worse. Up to 600,000 residences were directly affected by the ice storm, and up to 100,000 people were without power during the height of the storm. Some rural areas were without power for over 10 days.

Severe winter storm events tend to be regional in nature, affecting more than a single community or county. In fact, all of the local winter storm events for St. Croix County as reported in the National Climatic Data Center database were regional in nature and impacted more than just St. Croix County. Recent winter storm events in Wisconsin are summarized in **Table 21** below.

TABLE 21. Winter Storm Events • 1990 – Spring 2004
State of Wisconsin

December 2-4, 1990	10+" of snow across southern and central Wisconsin, with seven counties reporting 17"-22"
Oct 31-Nov 2, 1991	up to 35" of snow in Douglas County and over 30" in four other counties (Bayfield, Polk, St. Croix, Pierce)
late November 1991	snowstorm in northwestern Wisconsin, with up to 20" in parts of Sawyer County and nine counties receiving over 10"
February 1994	15+" of snow in five southern counties
January 1-3, 1999	10+" of snow in most of southern Wisconsin, with 18+" in five southeastern counties
December 2000	One of the 10 coldest Decembers on record. 15"-34" of snow in most of southern Wisconsin. 13 counties received a Presidential Emergency Declaration.
early winter 2001	¼" of ice in Oneida & Forest Counties.
winter 2001	12"-20" of snow across northern Wisconsin in late November, followed by additional heavy lake-effect snow throughout the season resulting in 1'-4' of accumulation from Douglas to Vilas Counties
February 2003	12"-20" of snow in northern Wisconsin, especially Price & Vilas County areas; freezing rain & ice in southern Wisconsin up to nearly 4" thickness in Sauk County area

source: Wisconsin Emergency Management. State of Wisconsin Hazard Mitigation Plan, October 2004

Local Events

Shown in **Table 22** is a listing of winter storm events, including winter storms, heavy snowfall, freezing rain/ice, blizzards, and extreme cold events that have been recorded by the National Climatic Data Center for St. Croix County since 1993.

TABLE 22. Winter Storm Events • 1993 – 2005
St. Croix County

Location	Date	Time	Type	Deaths	Injuries
Regional	1/5/1994	12:00 PM	Heavy Snow	0	0
Regional	1/26/1994	8:00 PM	Heavy Snow/Ice Storm	0	0
Regional	11/27/1994	9:00 AM	Heavy Snow	0	0
Regional	2/10/1995	9:00 PM	Cold	0	0
Regional	11/26/1995	8:00 PM	Heavy Snow	0	0
Regional	12/6/1995	8:00 PM	Heavy Snow	0	0
Regional	12/13/1995	6:00 AM	Glaze	0	0
Regional	1/17/1996	9:00 PM	Ice Storm	0	0
Regional	1/18/1996	5:00 AM	Heavy Snow	0	0
Regional	1/31/1996	5:00 AM	Extreme Cold	0	0
Regional	2/1/1996	12:00 AM	Extreme Cold	1	0
Regional	2/8/1996	12:00 AM	Freezing Rain	0	0
Regional	3/24/1996	1:00 AM	Heavy Snow	0	0
Regional	11/15/1996	1:00 AM	Ice Storm	0	0
Regional	11/23/1996	12:00 AM	Heavy Snow	0	0
Regional	12/14/1996	4:00 PM	Heavy Snow	0	0
Regional	12/23/1996	9:00 AM	Heavy Snow	0	0
Regional	1/15/1997	5:00 PM	Extreme Windchill	0	0
Regional	3/13/1997	1:00 AM	Winter Storm	0	0
Regional	1/4/1998	5:00 PM	Ice Storm	0	0
Regional	1/11/1998	10:00 AM	Winter Storm	0	0
Regional	1/22/1999	3:00 AM	Winter Storm	0	0
Regional	3/8/1999	8:00 AM	Winter Storm	0	0
Regional	1/12/2000	10:00 AM	Heavy Snow	0	0
Regional	12/28/2000	2:00 AM	Winter Storm	0	0
Regional	1/29/2001	7:00 PM	Winter Storm	0	0
Regional	2/7/2001	7:00 AM	Heavy Snow	0	0
Regional	3/12/2001	12:00 AM	Heavy Snow	0	0
Regional	3/8/2002	6:00 PM	Winter Storm	0	0
Regional	3/14/2002	8:00 AM	Winter Storm	0	0
Regional	2/2/2003	8:00 PM	Winter Storm	0	0
Regional	12/9/2003	3:00 AM	Winter Storm	0	0
Regional	1/26/2004	12:00 AM	Winter Storm	0	0
Regional	2/1/2004	2:00 AM	Winter Storm	0	0
Regional	3/5/2004	12:00 AM	Winter Storm	0	0
Regional	8/21/2004	2:00 AM	Frost/Freeze	0	0
Regional	1/1/2005	2:00 PM	Winter Storm	0	0
Regional	1/21/2005	2:00 PM	Winter Storm	0	0
Regional	2/19/2005	9:00 PM	Winter Storm	0	0
Regional	3/18/2005	6:00 AM	Winter Storm	0	0
Totals:	**40 events**			**1**	**0**

Source: National Climatic Data Center (NCDC), 1994-October 2006.

Winter storm data prior to 1994 for St. Croix County was not available through the NCDC database. In the National Climatic Data Center (NCDC) database, all reported winter storm events since 1994 were regional in nature, also affecting areas outside St. Croix County. The single death associated with the 1996 extreme cold event occurred when an Eau Claire woman locked herself in her garage.

Since 1994, St. Croix County has experienced 3.3 reported winter storm events per winter season, with a total of 40 winter storm events over twelve years. These events were further characterized by 12 heavy snowfall events, 6 freezing rain/ice storms/glaze, 4 extreme windchill or cold, 1 heavy snow/ice storms, and 17 winter storms. No deaths, injuries, property damage, or crop damage were reported in the NCDC database for St. Croix County due to winter storm events.

Overall, winter storms are most common from December through March. January had the highest number of reported events in the NCDC database with thirteen. The extreme cold events all occurred in late January and February. Freezing rain and frost can occur over the largest range of months, with once such frost event reported for August 21, 2004.

As the NCDC database shows, blizzards are indeed rare. While heavy snows may occur, these are seldom accompanied by the sustained high winds (35+ mph) associated with the blowing white-out conditions and drifting snows of a blizzard. Near blizzard conditions occurred in January 1979, December 1990, October 1991, and mostly lately in February 2007, but none of these events achieved snow fall amounts and sustained wind speeds in St. Croix County to truly constitute a blizzard.

One of the most significant winter storms in recent history does not appear in the NCDC database. On April 4, 1985, a winter storm hit west-central Wisconsin which resulted in the closure of portions of Interstate 94. Interstate travelers were unexpectedly sheltered as a result of this storm. More recently, a January 1996 winter storm dumped 12 inches of snow in the area, slowing Interstate traffic to a crawl. The NCDC database does not reflect the deaths, injuries, and damage caused by traffic accidents under winter storm conditions.

Winter storms often have the greatest impact on travel and transportation systems. Drifting of snow on many of the north-south roads of St. Croix County is not uncommon. However, drifting has not been a substantial problem as of late; and the wing blades on the County plow trucks have significantly mitigated the hazard on many roads.

The effect of winter storms on Interstate 94 travel is of greater significance. The I-94 segment between Eau Claire and Hudson is one of the most heavily traveled highways in the State of Wisconsin, second only to the stretch of I-94 in Kenosha County. Interstate traffic is also a mix of vehicle types; and travel often occurs at high speeds (65+ mph), which can be particularly dangerous during icy or white-out conditions. Winter storms often slow traffic; and about once every 25 years conditions are so bad that the Interstate closes, such as during the 1985 storm. Conditions can be particularly hazardous due to high traffic volumes on the five or so miles of I-94 east of the St. Croix River Bridge on the west side of the County.

Historically, other winter-related event impacts in St. Croix County in recent history have been primarily limited to scattered, short-term power outages and a limited number of areas

potentially prone to ice damming. The three areas noted for ice damming concerns during the planning process were:

- Ice damming on the Willow River immediately east of the City of New Richmond in the Town of Erin Prairie has caused serious flooding problems for 1-2 homes in the past, as well as a nearby highway, and may be related to a past NFIP claim. On occasion, dynamite has been used to breakup these dams.
- Some ice damming possibly caused by the old structures remaining from the Huntington Dam in the Town of Star Prairie have caused concern for potential damage to the nearby bridge and county highway. However, the remaining structures of the Huntington Dam have been recently removed; and this seems to have largely mitigated the worst of the ice damming of the past.
- Also in the Town of Star Prairie, ice is pushed up along the south shore of Cedar Lake building to heights of 10 to 15 feet, contributing to shoreland erosion, and threatening to damage adjacent homes.
- The Town of Somerset noted two areas which are prone to serious snow drifting on roads: (1) 230th Avenue between 40th Street and 50th Street, as well as adjacent areas of 50th Street, and (2) 210th Avenue east of Highway 35.
- Ice-damming has occasionally also been a concern at the historic Stillwater Lift Bridge at the unincorporated community of Houlton in the Town of St. Joseph. Though it is expected that the bridge will be limited to recreational use within the next 10 years, it may continue to be vulnerable to the impacts of flooding and ice-damming.

Relative Level of Risk

During the risk and vulnerability assessment survey (see Table 14), the Steering Committee ranked ice storms, heavy snow storms, and blizzards as the highest hazard risks based on the frequency of past occurrences and potential for reoccurrence. Extreme cold was ranked as a significantly lower risk. Overall, based on this survey, the relative level of risk for winter storm events should be considered moderately high for St. Croix County. However, while these winter storm events were ranked high for frequency, their potential for impact and damages (vulnerability) ranked slightly lower.

Ice storms/sleet and heavy snows/blizzards had an average vulnerability ranking of 3.34 on a scale of 0 to 5. While the potential impacts of these events are of concern, overall they were ranked as being somewhat less than when compared to some of the other potential disasters. The potential impacts of extreme cold were ranked as being much lower at 2.89.

It is anticipated that the frequency of winter storm events will continue, with St. Croix County experiencing three to four severe winter storms annually. These winter storms will include serious ice storms at least once every two years on average. Blizzards will be very rare, with a blizzard occurring no more frequently than once every 30 years.

Vulnerability Assessment—Winter Storms

Potential Impacts

Winter storms have no defined hazard area within St. Croix County; and, as the NCDC data previously showed, these storms tend to be regional in nature. Due to the irregular nature of these events and lack of specific hazard areas, the assessment of community impacts as a result of winter storms is difficult to quantify.

Winter storms can present a serious health and safety threat to area residents and can result in significant damage to property and infrastructure. Snow and ice are the major hazards associated with winter storms. Heavy snow or accumulated ice can cause the structural collapse of buildings or down power lines, severely affecting electrical power distribution, causing accidents (e.g., traffic crashes, slipping/falling), or restricting mobility of emergency assistance or access to services. Most structures in St. Croix County were built to standards which considered snowloads and needed insulation. The majority of injuries resulting from winter storms are vehicle accidents.

Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. When exposed to cold temperatures or low wind chills, one's body begins to lose heat faster than it can be produced. The result is hypothermia or abnormally low body temperature. A body temperature that is too low can affect the brain, making the victim unable to think clearly or move well. This makes hypothermia particularly dangerous because a person may not know it is happening and won't be able to do anything about it. Hypothermia occurs most commonly at very cold temperatures, but can occur even at cool temperatures (above 40°F) if a person becomes chilled from rain, sweat, or submersion in cold water. Victims of hypothermia are most often elderly people with inadequate food, clothing, or heating; babies sleeping in cold bedrooms; children left unattended; adults under the influence of alcohol; mentally ill individuals; and people who remain outdoors for long periods such as the homeless, hikers, hunters, those stranded in vehicles, etc.

Frostbite is an injury to the body that is caused by freezing. Frostbite causes a loss of feeling and color in affected areas. It most often affects the nose, ears, cheeks, chin, fingers, or toes. Frostbite can permanently damage the body, and severe cases can lead to amputation.

In addition to the health risks directly related to exposure to cold temperatures, residents are also susceptible to other risks associated with extremely cold temperatures. For example, many homes will become too cold either due to a power failure or because the heating system isn't adequate for the weather. Water lines can break. When people begin to use space heaters and fireplaces to stay warm, the risk of household fires increases as well as the risk of carbon monoxide poisoning. There can be economic impacts from the closure of businesses due to lack of mobility or power loss, but these are almost always very short-term impacts.

The winter kill of crops, especially alfalfa, has been a problem in St. Croix County about every five to six winters on average during extended cold periods when there is little or no snow cover. Four inches of snow will allow up to a 20°F difference in temperature between the soil and air, while inhibiting the premature breaking of dormancy during temporary warm spells. Snow cover in recent years has been below average and winter temperatures above normal. The impacts of

winter kill also vary by soil types and conditions throughout the County, and disease (e.g., root rot) can further contribute to the problem.

For alfalfa, winter kill can be worse when late season cuttings occur and little or no re-growth is allowed before winter arrives. Informational meetings and educational efforts are conducted to discuss these risks and potential mitigation steps. But under severe weather conditions, practices cannot fully mitigate the potential impacts.

Numbers on winter alfalfa losses for St. Croix County are not available, though during the 2002-2003 winter season, nearby Polk County lost approximately 61% of its alfalfa crops, resulting in an estimated $5 million in losses. The losses due to winter kill have not been as bad in St. Croix County, but the potential vulnerability for St. Croix County farmers could be even greater. In 2005, St. Croix County farmers produced 144,200 tons of forage alfalfa, 16% more than their Polk County counterparts.

With such hay and alfalfa yield losses, local farmers may need to purchase supplemental feed for livestock, costing as much as $1,500 of additional feed per mature cow. With approximately 64,000 head of cattle in St. Croix County, supplementing feed due to winter kill losses could be very costly for agricultural producers. Though rare, early frosts can also have severe impacts on agricultural crops. The last such event occurred the first week of September 1974 and stretched as far south as Manhattan, Kansas.

It is possible to complete an overall review of the community and identify facilities and community assets that may be at risk. Based on a review of the community, it was determined that the following general types of facilities and community assets are vulnerable to winter storm events:

- Residents and travelers
- Vulnerable populations, such as elderly (especially during extreme cold events)
- General utilities, including underground power lines, telephone lines, etc
- Operation of critical facilities
- Agricultural crop losses, especially alfalfa

Overall, there is a very low vulnerability to structures in St. Croix County due to winter storms. Some occasional roof damage due to ice damming or bursting of inadequately buried water lines can be expected, but such damage is almost always isolated, not officially reported, and/or remedied by the homeowner, often without an insurance claim. It is unfeasible for the County to maintain a database at this time which accurately details the structural condition of all $4.6 billion in assessed improvements in St. Croix County to determine which structures may be more vulnerable to the impacts of future winter storm events.

Although the improvement of technology has enabled meteorologists to better forecast and track winter storms, there is no precise way to predict the location and severity of their associated risks. There is a no predictable pattern of occurrence or associated risk characteristics and resulting damage that can be identified and used to make projections on future winter storm events. Frost and freezing rain can occur anytime from August through May, with heavy snow and winter storms primarily occurring from November through March. And, as stated earlier, there has been no reported damage in the NCDC database resulting from winter storm events.

Vulnerable Critical Facilities

A complete assessment of the community's assets (critical facilities) and their susceptibility to winter storms is located in **Appendix F**.

Utilities and infrastructure, and in particular elevated power lines in wooded areas, have the greatest vulnerability to winter storms and ice. St. Croix Energy Cooperative maintains roughly 800 miles of elevated power lines in St. Croix County and provides electric power to about 75% of the land area of St. Croix County, primarily in the unincorporated areas. For general planning purposes only, we can conclude that there is roughly $25 million in value of overhead single-phase and three-phase power lines in St. Croix County which are potentially vulnerable to winter storm events. [12]

Between 1998 and 2006, only 1.47% of the lost customer hours were directly attributed to snow and ice. However, nearly 36% of the total lost customer hours were due to trees falling on power lines, which would also be partially related to the high winds, snow, and ice which accompany winter storms. The vulnerabilities related to power loss are discussed in more detail under the previous tornado and high winds vulnerability assessment.

While there are few long-term physical impacts on roads from a hazard mitigation perspective, travel upon sidewalks, roads, and bridges is often hazardous under icy or heavy snow conditions as discussed previously. Such road conditions can also impair the function of critical facilities (e.g., staffing at hospitals or schools) and increase emergency response time.

Some scattered water line breaks are not uncommon for community water systems, especially in older neighborhoods, though many communities mitigate potential breaks by asking residents to leave water faucets dripping to prevent freeze-ups and have also replaced water mains in recent years to further address such problems.

Ice damming is a winter phenomenon which is also related to flooding. Though infrequent, ice dams occasionally contribute to localized flooding problems and can damage nearby roadways, bridges, and structures. As discussed previously, the number of events and structural damage related to ice damming in St. Croix County have not been significant to date.

Extreme cold and ice are also significant hazards for the elderly and those residing in assisted living facilities, though the physical facilities themselves have no unique vulnerabilities to winter storm events.

Unique Jurisdictional Risks or Vulnerabilities—Winter Storms

Winter storms pose no risks or vulnerabilities unique to individual jurisdictions. Winter storms and extreme cold events are typically large-area or regional events, occurring County-wide. The level of vulnerability increases in areas of higher population, development density, and supportive infrastructure as described previously in **Section II.** of the Community Profile. Any notable differences between municipalities regarding the vulnerability of winter storm and

[12] Assumes a roughly 80%/20% split of single-phase and three-phase lines with a replacement value of $28,000 and $44,000 respectively. Further assumes roughly 800 total miles of overhead power lines in St. Croix County total.

extreme cold events is further discussed in the *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G.**

Many of the incorporated communities reported infrequent and scattered water line freeze-ups or breaks. Water-dripping programs are sometimes used to mitigate potential damage. As budgets allow, older water lines potentially more prone to breaks are replaced as part of street projects. The Village of Roberts noted that mobile homes can be more vulnerable to the breakage of laterals at the meter since the water lines are sometimes less insulated than standard home construction.

Travel during snow-covered, blowing, or icy conditions on Interstate 94, especially within the Village of Hudson, was noted as a potential significant hazard due to the number of travelers and travel speeds. Some communities have hills which can be difficult under winter road conditions, such as 5th Street in the Village of Star Prairie, but these are typically prioritized for attention by local road crews. Glen Meadows Lane in the City of Glenwood City is a particularly narrow road on a hill which has an accident history when a vehicle with five children slid off and was pinned on a tree, avoiding serious injury.

In addition, the continuing changes in land-use and development patterns can influence the County's potential for future exposure to winter storms. As discussed previously, St. Croix County is continuing to grow and develop. This creates an increasing exposure to the number of residents and property that could be at risk from future winter storm or extreme cold events. Although new development is managed to insure adequate protection services are provided, continued growth increases the overall land area capable of being impacted by hazard events. Overall, St. Croix County's villages, cities, and towns are well prepared to meet the challenges of cold weather and winter storms

iii. Thunderstorms (including lightning & hail)

Risk Assessment—Thunderstorms

The Hazard

Thunderstorms are severe and violent forms of convection produced when warm moist air is overrun by dry cool air. As the warm air rises, thunderheads (cumuli-nimbus clouds) form which cause the strong winds, lightning, thunder, hail and rain associated with these storms. The National Weather Service definition of a severe thunderstorm is a thunderstorm event that produces any of the following: winds of 58 miles per hour or greater (often with gusts of 74 miles per hour or greater), hail 3/4 inch in diameter or greater, or a tornado.

The thunderheads formed may be a towering mass six miles or more across and 40,000 to 50,000 feet high. They may contain as much as 1 ½ million tons of water and enormous amounts of energy that often are released in the form of high winds, excessive rains, and three violently destructive natural elements: lightning, hail, and tornadoes.[13]

Lightning can strike anywhere. Lightning is formed from the build-up of an electrical charge in a cloud. When this charge is big enough, the air ionizes and a discharge occurs with another cloud, the ground, or the best conducting object. The resulting electric charge reaches temperatures higher than 50,000°F. This rapid heating and subsequent cooling causes the air to expand and contract, which results in thunder.

HAIL or a hailstorm is a weather condition where atmospheric water particles form into masses of ice that fall to earth. Hail is a product of strong thunderstorms that frequently move across the County. Hail normally falls near the center of the moving storm along with the heaviest rain; however, the strong winds at high altitudes can blow the hailstones away from the storm center, causing unexpected hazards at places that otherwise might not appear threatened.

Hailstones normally range from the size of a pea to that of a golf ball, but sizes larger than baseballs have occurred with the most severe storms. They form when sub-freezing temperatures cause water in thunderstorm clouds to accumulate in layers around an icy core. When strong underlying winds no longer can support their weight, the hailstones fall earthward. Hail tends to fall in swaths that may be 20 to 115 miles long and 5 to 30 miles wide. The swath is not normally a large, continuous bombardment of hail, but generally consists of a series of hail strikes that are produced by individual thunderstorm clouds traversing the same general area. Hail strikes are typically one-half mile wide and five miles long. They may partially overlap, but often leave completely undamaged gaps between them.

Most thunderstorms and associated hazards (e.g., hail, lightning, high wind) often last no more than 30 minutes, as an individual thunderstorm cell frequently moves between 30 to 50 miles per hour. Strong frontal systems, though, may spawn more than one squall line composed of many individual thunderstorm cells. These fronts can often be tracked from west to east. Because

[13] Tornadoes are discussed separately in Section III.B.i.

thunderstorms may occur singly, in clusters, or as a portion of large storm lines, it is possible that several thunderstorms may affect one in the course of a few hours.

Regional Trends

Wisconsin averages over 30 days each year with severe thunderstorms. In some areas of the southwestern counties of the State, thunderstorms occur on an average of 40-50 days per year. Over the past 30 years, Wisconsin has experienced hurricane-force winds of 75 mph or higher on 120 days (an average of 4 days per year). Winds at or above 100 mph were documented on 17 days during the same time period, which is similar to experiencing a Category 2 hurricane in the State of Wisconsin about one day every two years on average. Between 1982 and 2001, wind damage to twenty facilities was attributed to severe thunderstorms in Wisconsin.

Hail causes $1 billion in damages to crops and property in the United States each year. Wisconsin averages two to three hail days per year as recorded by the National Weather Service, but some hail events likely go unreported. 85% of hailstorms in Wisconsin occur between the months of May and September.

A Presidential Disaster Declaration was issued for a July 15, 1980, wind, hail, and isolated tornadoes event which occurred across much of west-central Wisconsin and resulted in about $240 million in agricultural and property damage. On May 31, 1998, widespread, straight-line winds caused an estimated $55.85 million in damages across 20 southern Wisconsin counties. In July 1999, high winds over the month affected an estimated 92,000-acre area of forests with approximately 12,000 acres of trees nearly 100% toppled in northwestern Wisconsin. On May 12, 2000, ten counties across central Wisconsin were pounded by hailstones 1" to 3" in diameter which injured 36 people and resulted in an estimated $121 million in damage.

Local Events

Shown in **Table 23** is a listing of severe thunderstorms that have been reported to the National Climatic Data Center for St. Croix County since 1966.

Since 1966, a total of 159 severe thunderstorm events of varying magnitude have been reported for St. Croix County, including some multiple reports within a single day for large storm cells or for different geographical locations within the County. Although the storms listed in Table 23 are classified as thunderstorms, each of these storms had its own unique characteristics and associated risks to residents and property in St. Croix County, including high winds, lightning, and hail. However, other risks associated with thunderstorms that were able to be documented with these storms include the potential for excessive rains leading to flash flooding and the potential to spawn tornadoes.

Data prior to 1986 is relatively limited and not consistently reported, with only 21 such events reported (approximately one event reported each year on average during this period). Since 1986, reports for St. Croix County have averaged 3.4 severe thunderstorms event days per year. Table 23 also shows that thunderstorms can occur nearly throughout the year, with thunderstorms reported as late as December and as early as March. Over 35% of the reported severe thunderstorm event days since 1986 occurred in June, and nearly 70% of the event days occurred between the months of May through July.

TABLE 23. Severe Thunderstorm Events, including high winds • 1966 to 2005
St. Croix County

Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
St. Croix County	7/12/1966	30	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	6/8/1968	1930	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	8/6/1968	940	Tstm Wind	60 kts.	0	0	$0	$0
St. Croix County	5/19/1975	1530	Hail	2.50 in.	0	0	$0	$0
St. Croix County	6/15/1976	5	Hail	1.00 in.	0	0	$0	$0
St. Croix County	9/8/1977	2315	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/12/1978	2040	Hail	2.50 in.	0	0	$0	$0
St. Croix County	7/12/1978	2115	Hail	1.75 in.	0	0	$0	$0
St. Croix County	6/19/1979	2215	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/11/1980	2030	Hail	3.00 in.	0	0	$0	$0
St. Croix County	7/11/1980	2030	Tstm Wind	69 kts.	0	0	$0	$0
St. Croix County	6/14/1981	500	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	6/14/1981	1610	Tstm Wind	60 kts.	0	0	$0	$0
St. Croix County	7/6/1982	100	Tstm Wind	78 kts.	0	0	$0	$0
St. Croix County	7/19/1983	1530	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	4/27/1984	1120	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/14/1984	1600	Tstm Wind	0 kts.	0	1	$0	$0
St. Croix County	7/14/1984	1615	Tstm Wind	0 kts.	0	1	$0	$0
St. Croix County	10/16/1984	1945	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	3/31/1986	1705	Hail	0.75 in.	0	0	$0	$0
St. Croix County	6/23/1986	1520	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	6/23/1986	1535	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/24/1986	1240	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/27/1986	400	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/27/1986	415	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/27/1986	430	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	8/16/1986	1949	Hail	0.75 in.	0	0	$0	$0
St. Croix County	6/28/1987	1640	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/6/1987	1527	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	7/23/1987	1310	Hail	1.00 in.	0	0	$0	$0
St. Croix County	7/23/1987	1330	Tstm Wind	70 kts.	0	0	$0	$0
St. Croix County	7/25/1987	2302	Hail	2.75 in.	0	0	$0	$0
St. Croix County	6/19/1988	1748	Hail	4.50 in.	0	0	$0	$0
St. Croix County	6/19/1988	1757	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	8/7/1988	1815	Tstm Wind	0 kts.	0	1	$0	$0
St. Croix County	8/7/1988	1835	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	5/29/1989	1359	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	6/30/1989	1745	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	6/2/1990	1300	Tstm Wind	56 kts.	0	0	$0	$0
St. Croix County	6/12/1990	1805	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	8/26/1990	400	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	4/7/1991	2010	Hail	1.75 in.	0	0	$0	$0
St. Croix County	5/28/1991	2230	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	5/28/1991	2230	Tstm Wind	0 kts.	1	0	$0	$0

St. Croix County	5/28/1991	2245	Tstm Wind	0 kts.	0	0	$0	$0
St. Croix County	5/28/1991	2305	Tstm Wind	0 kts.	0	0	$0	$0
Burkhardt	4/26/1994	1100	Hail	0.75 in.	0	0	$0	$0
Hudson	4/26/1994	1100	Tstm Wind	N/A	0	0	$0	$0
Baldwin	4/26/1994	1125	Hail	0.75 in.	0	0	$0	$0
Glenwood City	4/26/1994	1130	Hail	0.75 in.	0	0	$0	$0
Somerset	5/30/1994	1538	Hail	1.50 in.	0	0	$0	$0
Hudson	5/30/1994	1540	Tstm Wind	N/A	0	0	$51,350	$5,135
Somerset	6/25/1994	1600	Tstm Wind	N/A	0	0	$0	$51,350
Star Prairie	6/25/1994	1610	Tstm Wind	N/A	0	0	$513,500	$51,350
River Falls	6/27/1994	1743	Hail	0.75 in.	0	0	$0	$0
Hudson	7/5/1994	430	Tstm Wind	N/A	0	0	$5,135	$1,027
Deer Park	6/25/1995	1435	Tstm Wind	N/A	0	0	$0	$0
Deer Park	6/25/1995	1435	Tstm Wind	N/A	0	0	$0	$0
Star Prairie	6/25/1995	1515	Hail	0.75 in.	0	0	$0	$0
Star Prairie	6/25/1995	1515	Hail	0.75 in.	0	0	$0	$0
Burkhardt	6/25/1995	1600	Hail	0.75 in.	0	0	$0	$0
Burkhardt	6/25/1995	1600	Hail	0.75 in.	0	0	$0	$0
Hudson	6/26/1995	1520	Tstm Wind	N/A	0	0	$0	$0
Regional	8/11/1995	800	Heavy Rain	N/A	0	0	$0	$0
Regional	8/11/1995	800	Heavy Rain	N/A	0	0	$0	$0
Maiden Rock	8/12/1995	2032	Tstm Wind	N/A	0	0	$0	$0
Maiden Rock	8/12/1995	2032	Tstm Wind	N/A	0	0	$0	$0
Hudson	5/17/1996	10:30 PM	Hail	1.75 in.	0	0	$0	$0
Hudson	5/17/1996	10:30 PM	Tstm Wind	52 kts.	0	0	$0	$0
New Richmond	5/17/1996	10:45 PM	Hail	1.00 in.	0	0	$0	$0
New Richmond	5/18/1996	10:45 PM	Hail	1.00 in.	0	0	$0	$0
New Richmond	5/19/1996	12:05 AM	Tstm Wind	52 kts.	0	0	$0	$0
Hudson	5/19/1996	12:55 AM	Tstm Wind	85 kts.	0	0	$3,034,560	$0
Roberts	5/19/1996	01:05 AM	Tstm Wind	70 kts.	0	0	$3,277,325	$364,147
River Falls	5/19/1996	01:15 AM	Tstm Wind	70 kts.	0	0	$0	$0
Baldwin	6/26/1996	12:09 PM	Hail	0.75 in.	0	0	$0	$0
River Falls	10/16/1996	06:59 PM	Hail	0.75 in.	0	0	$0	$0
Hammond	10/16/1996	07:30 PM	Hail	0.88 in.	0	0	$0	$0
Regional	10/29/1996	11:00 PM	High Wind	50 kts.	0	0	$0	$0
Baldwin	6/15/1997	02:15 PM	Hail	0.75 in.	0	0	$0	$0
River Falls	6/15/1997	02:15 PM	Hail	0.75 in.	0	0	$0	$0
New Richmond	6/28/1997	09:05 AM	Tstm Wind	55 kts.	0	0	$0	$0
Hudson	7/1/1997	07:42 PM	Tstm Wind	52 kts.	0	0	$0	$0
Woodville	3/29/1998	04:04 PM	Hail	0.75 in.	0	0	$0	$0
River Falls	5/30/1998	10:15 PM	Tstm Wind	75 kts.	0	0	$144,846	$0
Roberts	6/15/1998	06:48 PM	Hail	1.75 in.	0	0	$0	$0
Hudson	6/15/1998	07:10 PM	Hail	1.75 in.	0	0	$0	$0
Glenwood City	6/25/1998	01:26 AM	Tstm Wind	55 kts.	0	0	$0	$0
Hudson	6/26/1998	11:16 PM	Tstm Wind	56 kts.	0	0	$0	$0
Baldwin	6/5/1999	04:30 PM	Hail	1.75 in.	0	0	$0	$0
Deer Park	6/5/1999	04:30 PM	Tstm Wind	52 kts.	0	0	$0	$0
Deer Park	7/23/1999	01:28 AM	Tstm Wind	60 kts.	0	0	$0	$0
Hudson	7/23/1999	01:28 AM	Tstm Wind	60 kts.	0	0	$0	$0

Somerset	7/30/1999	05:15 PM	Tstm Wind	52 kts.	0	0	$0	$0
Somerset	7/30/1999	05:33 PM	Tstm Wind	50 kts.	0	0	$0	$0
New Richmond	7/30/1999	05:40 PM	Tstm Wind	50 kts.	0	0	$0	$0
River Falls	7/30/1999	05:52 PM	Hail	0.75 in.	0	0	$0	$0
River Falls	7/7/2000	10:30 AM	Tstm Wind	55 kts.	0	0	$0	$0
Somerset	7/7/2000	10:30 AM	Tstm Wind	55 kts.	0	0	$0	$0
Hudson	7/7/2000	10:50 AM	Hail	0.75 in.	0	0	$0	$0
North Hudson	8/7/2000	11:10 PM	Tstm Wind	50 kts.	0	0	$0	$0
Somerset	8/12/2000	10:35 PM	Lightning	N/A	1	2	$0	$0
Hudson	8/26/2000	01:00 AM	Tstm Wind	50 kts.	0	0	$0	$0
River Falls	8/26/2000	01:20 AM	Tstm Wind	50 kts.	0	0	$0	$0
Hudson	10/26/2000	05:14 PM	Hail	1.00 in.	0	0	$0	$0
River Falls	10/26/2000	05:33 PM	Hail	1.00 in.	0	0	$0	$0
Regional	4/7/2001	09:15 AM	High Wind	53 kts.	0	0	$1,084,510	$0
River Falls	5/1/2001	05:30 PM	Hail	1.25 in.	0	0	$0	$0
River Falls	5/1/2001	05:40 PM	Hail	1.75 in.	0	0	$3,253,529	$0
River Falls	5/1/2001	05:40 PM	Tstm Wind	55 kts.	0	0	$0	$0
Baldwin	5/1/2001	06:04 PM	Hail	1.75 in.	0	0	$0	$0
Hudson	5/6/2001	06:51 PM	Tstm Wind	60 kts.	0	0	$0	$0
New Richmond	6/11/2001	04:40 PM	Tstm Wind	52 kts.	0	0	$0	$0
Star Prairie	6/11/2001	05:38 PM	Tstm Wind	50 kts.	0	0	$0	$0
Glenwood City	6/11/2001	05:48 PM	Tstm Wind	52 kts.	0	0	$0	$0
Hammond	6/18/2001	05:45 AM	Hail	0.75 in.	0	0	$0	$0
Baldwin	6/18/2001	05:50 AM	Hail	1.00 in.	0	0	$0	$0
Somerset	7/17/2001	11:05 PM	Tstm Wind	50 kts.	0	0	$0	$0
Roberts	4/18/2002	03:30 AM	Hail	0.75 in.	0	0	$0	$0
Somerset	5/5/2002	05:39 PM	Hail	1.75 in.	0	0	$0	$0
Star Prairie	5/5/2002	05:53 PM	Hail	0.75 in.	0	0	$0	$0
New Richmond	5/5/2002	05:55 PM	Hail	1.75 in.	0	0	$0	$0
Glenwood City	5/5/2002	06:17 PM	Hail	1.75 in.	0	0	$0	$0
North Hudson	5/5/2002	06:30 PM	Hail	1.75 in.	0	0	$0	$0
Hudson	5/5/2002	06:40 PM	Hail	0.75 in.	0	0	$0	$0
Star Prairie	6/25/2002	07:15 PM	Hail	1.00 in.	0	0	$0	$0
Star Prairie	6/25/2002	07:15 PM	Tstm Wind	60 kts.	0	0	$0	$0
Glenwood City	6/25/2002	07:45 PM	Tstm Wind	50 kts.	0	0	$0	$0
Somerset	7/28/2002	06:10 PM	Tstm Wind	52 kts.	0	0	$0	$0
New Richmond Arpt	7/28/2002	06:25 PM	Tstm Wind	51 kts.	0	0	$0	$0
Deer Park	7/28/2002	06:28 PM	Tstm Wind	55 kts.	0	0	$10,674	$0
Hudson	9/1/2002	10:00 PM	Tstm Wind	55 kts.	0	0	$0	$0
Baldwin	9/1/2002	10:15 PM	Tstm Wind	55 kts.	0	0	$0	$0
Hudson	7/4/2003	03:05 AM	Tstm Wind	52 kts.	0	0	$0	$0
New Richmond	7/4/2003	03:20 AM	Tstm Wind	60 kts.	0	0	$0	$0
Roberts	7/4/2003	03:20 AM	Tstm Wind	55 kts.	0	0	$0	$0
Somerset	7/11/2003	04:41 PM	Hail	1.00 in.	0	0	$0	$0
River Falls	4/18/2004	01:05 AM	Hail	1.00 in.	0	0	$0	$0
Glenwood City	4/18/2004	01:46 AM	Hail	1.50 in.	0	0	$0	$0
Regional	4/18/2004	01:00 PM	High Wind	59 kts.	0	0	$0	$0
Hudson	5/9/2004	05:15 PM	Tstm Wind	50 kts.	0	0	$0	$0
New Richmond	5/9/2004	05:16 PM	Tstm Wind	50 kts.	0	0	$0	$0

Woodville	6/12/2004	07:51 PM	Hail	0.75 in.	0	0	$0	$0
Hudson	9/23/2004	01:40 PM	Tstm Wind	52 kts.	0	0	$0	$0
Hammond	10/29/2004	06:05 PM	Tstm Wind	55 kts.	0	0	$0	$0
Hammond	10/29/2004	06:05 PM	Tstm Wind	55 kts.	0	0	$0	$0
Emerald	10/30/2004	01:40 AM	Tstm Wind	52 kts.	0	0	$0	$0
Regional	12/12/2004	08:00 AM	Strong Wind	N/A	0	0	$1,027	$0
Houlton	6/5/2005	04:00 PM	Tstm Wind	50 kts.	0	0	$0	$0
Hudson	6/5/2005	04:07 PM	Tstm Wind	50 kts.	0	0	$0	$0
Somerset	6/7/2005	07:20 AM	Hail	0.75 in.	0	0	$0	$0
Somerset	6/7/2005	07:24 AM	Lightning	N/A	0	1	$0	$0
Glenwood City	6/8/2005	03:30 AM	Hail	0.75 in.	0	0	$0	$0
Hammond	6/8/2005	03:55 AM	Hail	0.88 in.	0	0	$0	$0
Hudson	6/8/2005	04:45 AM	Lightning	N/A	0	0	$0	$0
Roberts	6/20/2005	12:30 PM	Tstm Wind	52 kts.	0	0	$0	$0
River Falls	6/27/2005	06:50 PM	Tstm Wind	52 kts.	0	0	$0	$0
Glenwood City	6/29/2005	10:30 PM	Hail	0.88 in.	0	0	$0	$0
New Richmond	6/29/2005	10:35 PM	Tstm Wind	55 kts.	0	0	$0	$0
Total	159				2	6	$11,376,456	$473,009

Source: St. Croix County Hazard Analysis, 2005; National Climatic Data Center (NCDC) 1950-Summer 2005
Damage estimates in current dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

Of the thunderstorm events listed in Table 23 since 1986, 82 reports had high winds associated with them, 51 included hail, two had heavy rains, and three were noted for severe lightning. With approximately 3.4 such event days per year, thunderstorms, high winds, and hail are relatively common, though only 14% of the event days had corresponding damage estimates. However, keep in mind that damages in NCDC database often go unreported or under-reported, and often do not reflect typical maintenance and clean-up by municipalities following an event, as well as all clean-up costs or insurance claims by private landowners if substantial structural damage did not occur.

Recent thunderstorm and high wind-related damages in St. Croix County have averaged $104,829 per event (*not event days*) with 4.3 such events reported annually based on the NCDC data. Hail events are less frequent, with 2.7 such events reported annually, with an average of $63,795 in reported property damage per event; no hail-related crop damage estimates for St. Croix County are provided in the NCDC database or other readily available sources.

Only three lightning events were recorded in the database, all three being recorded since 2000. Based on this trend, a serious lightning event could be expected once every two years, on average. But it is also likely that lightning often goes unreported as a separate event, and lightning does occur as part of many of the other reported thunderstorm/high wind events. No crop or property damage is attributed to the three reported lightning events. However, of the two thunderstorm-related deaths between 1986 and 2005, one was attributed to lightning. And of the four thunderstorm-related injuries during this same timeframe, three are attributed to lightning. For St. Croix County residents over the past fifty years, lightning is the component of a severe thunderstorm which has been the most deadly or injurious, not high winds or hail.

The May 19, 1996, thunderstorm with high winds resulted in over $6.6 million in property and crop damages alone, and represents 56% of all thunderstorm-related damages in Table 23 above, demonstrating the possible severity of a single storm, but inflating the previous averages.

The National Weather Service is able to forecast and track thunderstorms that are capable of producing severe weather conditions such as high winds, hail, lightning, and possibly tornadoes. Although the improvement of technology has enabled meteorologists to better forecast and monitor thunderstorms, there is no precise way to predict the location and severity of their associated risks over the long term.

It is expected that current trends will continue for St. Croix County, with approximately three to four (3-4) severe thunderstorm events occurring annually. Most events will occur with minimal property and crop damage. However, based on past trends, it should also be expected that an occasional very severe thunderstorm with very high winds or severe hail will occur once every six to seven years (6-7) which will result in multi-millions of dollars in damage to property and/or crops due to very high wind, lightning, and hail.

Relative Level of Risk

Overall, thunderstorms were the sixth-highest ranked hazard type in the risk and vulnerability assessment survey (see Table 14). This ranking was in large part due to it receiving a high risk ranking (3.56 out of 5.00) based on frequency of occurrence and the high probability of severe thunderstorm reoccurrence.

The vulnerability ranking (3.11) for thunderstorms was significantly lower than its risk ranking, given the moderate, yet potentially serious impacts of thunderstorm events. This may be in part due to the one lightning-related death and three related injuries since 2000. During the key-informant interview process with local officials, it was the high, straight-line wind attribute of thunderstorms which received the greatest concern, with potential impacts similar to those of a tornado, but more frequently occurring.

Vulnerability Assessment—Thunderstorms

Potential Impacts

Thunderstorms have no defined hazard area within St. Croix County. Due to the irregular nature of these events and no specific hazard areas, the impacts as a result of a thunderstorm are difficult to quantify. As Table 23 showed, most thunderstorm events occur with minimal or no negative impacts.

In general, thunderstorms and associated hazards can cause damage to houses or property, uproot trees, and topple (or cause lightning damage to) power lines. Roadways can also be blocked by debris, and debris can accumulate in rivers or stormwater systems and contribute to washouts or flooding. Severe thunderstorms can cause injury or death from lighting, falling trees, downed power lines, and high wind impacts. They may cause power outages, disrupt telephone service, and severely affect radio communications and surface/air transportation, which may seriously tax the emergency management capabilities of the affected municipalities. High wind impacts and vulnerabilities are analyzed in the previous section (Section III.B.i.) as part of the tornado hazard

assessment. Stormwater and other flooding impacts are discussed separately as part of the flooding hazard assessment in Section III.B.v.

Hail or hailstorms are considered formidable among the weather and climatic hazards to property and crops of the interior plains of the U.S. because they dent vehicles and structures, break windows, damage roofs, and batter crops to the point that significant agricultural losses result. Serious injury and loss of human life, however, are rarely associated with hailstorms. Hail can cause serious injury and damage to buildings, personal property (vehicles), and crops. The most serious damage occurs when hailstones reach a diameter of 1.5 inches, which happens in less than half of all such storms.

Lightning can result in serious injury, start forest or structural fires, short-out electrical systems, disrupt electromagnetic transmissions, cause wide-spread losses of power, and even cause death for people or livestock. Lightning damage results from the four effects of lightning strikes: (1) electrocution/severe shock of humans and animals, (2) vaporization of materials along the path of the lightning strike, (3) fire caused by the high temperatures associated with lightning (as high as 50,000 degrees F), and (4) the sudden power surge which can damage electrical/electronic equipment.

To the general public, lightning is often perceived as a minor hazard. However, damage, injuries and deaths resulting from lightning indicate that it is a significant hazard. Between 1995 and 2002, there were 364 deaths due to lightning in the United States. Wisconsin has a high frequency of property losses because of lightning. Insurance records show that annually one out of every fifty farms has been struck by lightning or has had a fire that may have been caused by lightning. Generally, rural fires are more destructive that urban fires because of limited lightning protection devices, isolation, longer response times, and inadequate water supplies.

Large outdoor gatherings (sporting events, concerts, campgrounds, etc.) are particularly vulnerable to lightning strikes that may result in injuries and deaths. This was certainly the case in August 2000 when one man died and four others were injured at the Apple River Campground as part of the Ozzfest Music Festival near Somerset; it should be noted that the NCDC data only identifies two injuries associated with this event. This vulnerability underscores the importance of developing site-specific emergency procedures for these types of events, with particular emphasis on adequate early warning. Early warning of lightning hazards, combined with prudent protective actions, can greatly reduce the likelihood of lightning-related injuries and deaths.

The damages associated with thunderstorms can also be caused by related flooding, especially during the spring if water levels are already high or the ground is still saturated due to the spring melt of snows. Such was the case in most recent significant flooding event in 2001. The risks and vulnerabilities related to flooding will be analyzed in greater detail later in this report.

Based on key-informant interviews, past event history, and a review of the community, it was determined that the following general types of facilities and community assets are vulnerable to thunderstorm (non-flooding) events:

- Mobile homes, especially if unanchored
- General utilities, in particular overhead power lines

During planning meetings, unanchored mobile housing units were especially recognized as a high vulnerability for both tornadoes and high winds events, as discussed previously. It is likely that many, if not most, of the older mobile homes are unanchored, especially in the unincorporated areas. But based on discussions with local officials, few new mobile homes are being installed and no new mobile home parks are expected, especially in those western portions of the County where land values discourage such development. Many community officials also noted that electrical power outages due to tornadoes, high winds, lightning, and ice storms have not been uncommon during the past 30 years, though they do often affect large areas and occasionally for considerable lengths of time.

The continuing changes in land use and development patterns can influence the County's potential for future exposure to thunderstorms. As discussed in the community profile, St. Croix County is continuing to grow and develop. This creates an increasing exposure to the number of residents and properties that could be at risk from future events. Although new development is managed to insure adequate protection services are provided and construction is governed by the most current building codes, continued growth increases the vulnerability to hazard events.

Vulnerable Critical Facilities

A complete assessment of the community's assets (critical facilities) and their susceptibility to thunderstorms is located in **Appendix F**.

The vulnerability assessment showed that utilities and infrastructure, and in particular elevated power and communication lines, have the greatest vulnerability to thunderstorm events from downed power lines or lightning strikes as discussed previously.

As discussed in the tornado assessment, trees falling on power lines were the largest cause of power outages between 1998 and 2006 for the St. Croix Energy Cooperative, which serves about 75% of the land area of the County. Approximately 36% of the total lost customer hours during this timeframe were due to trees falling on overhead power lines, with high winds being the likely biggest contributing factor. Approximately 10% of all outages were related to lightning strikes, only slightly less than the tree-related causes which were 12.4% of all outages. However, the lightning-related outages accounted for a much lower percentage of total lost customer hours at 7.7%

And while electric lines in forested areas are most vulnerable, all such power lines are vulnerable during extremely high winds; and mitigation for all such circumstances is not feasible. As an example, in the Summer of 2005, power poles in good condition in an open field area in nearby Dunn County were "snapped-off" due to high winds approaching 100 miles per hour. In recent years, St. Croix County has been fortunate and has not had an extended power outage related to thunderstorms.

High winds and lightning can also affect radio communications and antennas, potentially impacting weather warning systems and the coordination of emergency response providers. This could be a particular concern for eastern portions of the County where such towers are fewer in number and topography is often a barrier to good radio or wireless communication. Lightning at the New Richmond Airport also tends to damage a light once per year on average. And lightning also occasionally strikes municipal well or wastewater infrastructure.

Other than those critical facilities with large span structures (e.g., school gyms) as discussed in the tornado and high winds section, the other critical facilities have low or no unique vulnerabilities to thunderstorm events, with many having back-up power generators if power should be lost.

Unique Jurisdictional Risks or Vulnerabilities--Thunderstorms

Like tornadoes and winter storms, thunderstorms pose no risks or vulnerabilities unique to individual jurisdictions. The level of vulnerability increases with development density, population density, age of homes, and value of improvements. As such, cities and villages are the highest vulnerability areas as well as those areas of with higher populations, larger numbers of housing units, and higher assessed value per square mile described previously in **Section II.C. & D.** of the Community Profile.

Any notable differences between municipalities regarding their vulnerability to thunderstorm and high wind events is further discussed in the *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G**. In general, most communities report no unique issues, with high straight-line winds occurring every 5 to 10 years on average and more infrequent heavy hail.

Typical thunderstorm damage in the past includes trees toppled, roofs damaged, and large amounts of debris and garbage clean-up. However, such clean-up is considered normal and not noteworthy in most cases. The Village of Baldwin has implemented a tree ordinance which may help keep the community's silver maples healthy and less prone to storm damage, while the Village of Wilson has two very large, old oaks which are significant features of the community.

The most significant concerns noted for the incorporated communities were related more to non-resident visitors during events or the summer months, such as the County Fair in the City of Glenwood City or the concerts and inner-tubers in the Village of Somerset. Historically, there have been injuries and even death due to lightning strikes related to such events, but tornadoes pose a bigger threat as experienced in 1899 when the tornado struck New Richmond just as the circus ended for the day.

iv. Drought

Risk Assessment—Drought

The Hazard

A **drought** is an extended period of unusually dry weather which may be accompanied by extreme heat (temperatures which are 10 or more degrees above the normal high temperature for the period). Drought conditions may vary from below-normal precipitation for a few weeks to severe lack of normal precipitation for multiple months. There are basically two types of drought in Wisconsin, agricultural and hydraulic. **Agricultural drought** is a dry period of sufficient length and intensity that markedly reduces crop yields. **Hydraulic drought** is a dry period of sufficient length and intensity to affect lake and stream levels and the height of the groundwater table. These two types of drought may, but do not necessarily, occur at the same time.

National & Regional Trends

In general, for Wisconsin, droughts have the greatest impact on agriculture. Small droughts of limited duration can significantly reduce crop growth and yields. More substantial events can decimate croplands and result in total loss. Droughts also greatly increase the risk of forest fires and wildfires because of extreme dryness. In addition, the loss of vegetation in the absence of sufficient water can result in flooding, even from average rainfall, following drought conditions.

Drought is a relatively common phenomenon in Wisconsin and has occurred statewide in 1895, 1910, 1939, 1948, 1958, 1976-77, and 1989. A Presidential Emergency Declaration was approved for the 1976 drought, which included St. Croix County. State and Federal drought assistance helped Wisconsin farmers recover from losses from drought conditions in 1987-1988, characterized by below-normal precipitation, persistent dry air, and above-normal temperatures. At that time, fifty-two percent of Wisconsin's 81,000 farms were estimated to have crop losses of 50% or more, with 14% estimated at 70% or more.

Drought conditions in the summer of 2003, combined with exceptionally cold temperatures, deep frost, and lack of snowfall the previous winter, resulted widespread winter kill and crop losses, with much of Wisconsin being included in a USDA Secretary of Agriculture Disaster Declaration for agricultural losses.

Local Events

The National Climatic Data Center database includes no drought records which include St. Croix County. The *St. Croix County Hazard Analysis-2005* identifies four significant drought events in the last century:

Date	Location/Description
1936	Most of the County
1976	Most of the County
1988	All of the County
2003	All of the County

All of the above noted drought events were regional in nature with drought conditions not limited to St. Croix County. During the three drought events over the last 30 years, there were no known human fatalities or injuries directly attributed to drought conditions; such impacts could more appropriately be associated with extreme heat conditions which may accompany a drought. St. Croix County suffered severe crop yield decline, and many wells dried up in the 1976 drought. In 1988 and 2003, St. Croix County also suffered severe crop yield decline, surface water levels decreased in many areas, and some ponds dried up.

Drought conditions have been impacting corn and soybean yields to some degree in the County about once in every 5-6 years, though a disaster declaration was not declared in all of these instances. The most recent event resulted in St. Croix County being part of an USDA Secretary of Agriculture Disaster Declaration in 2003 due to agricultural losses caused by exceptionally cold temperatures, lack of snow, deep frost, and drought that occurred from July 1, 2002, to September 30, 2003.

Soil types greatly influence drought risk. Large areas of sandier soils can be found in north-central portion of the County (e.g., Towns of Hammond, Erin Prairie, Richmond, Star Prairie, and Stanton) which have low moisture-holding capacity. Some of these sandier, well-drained soils experience drought-like effects almost annually, and can experience the lowest yields when a true drought is declared. To mitigate potential drought impacts, crop irrigation through high capacity wells and sprinkler systems is often used.

Reliably predicting drought events over the very long term is difficult, if not impossible. The Palmer Drought Index (http://www.drought.noaa.gov/palmer.html) has proven to be an effective means of determining long-term drought over several months. The Palmer Index uses temperature and rainfall information in a formula to determine dryness, and is not as effective with short-term forecasts (over a few weeks). Various drought and moisture indices and outlooks are available on-line, providing some forewarning of possible near future drought conditions.

Relative Level of Risk

Drought were rated as a low-to-moderate hazard risk for St. Croix County (see Table 14). The recent drought conditions and crop losses during the summer of 2003, combined with recent media attention on global climate change, may have increased the attention to the risks and vulnerabilities of this hazard.

Based on past trends, a serious drought can be expected to impact St. Croix County at a frequency of once every ten years. This frequency could increase if the impacts of a global climate change occur as discussed earlier in this report.

Vulnerability Assessment—Drought

Potential Impacts

A true drought has no defined hazard area within St. Croix County and most times these events affect the entire County. Some sandier soils may experience localized drought-like conditions more frequently; but a true drought is typically regional in nature and affects many counties, if not entire states.

Drought was determined not to pose a direct, substantial, or unique risk to any structures or buildings in St. Croix County. Agricultural operations are most vulnerable to drought in St. Croix County, especially crops, but also livestock under certain conditions (e.g., nitrate build-up in feed, lack of water supply). These facts are particularly important given that agriculture is the still the predominant land use in St. Croix County.

During the 2002-2003 drought and related winter kill, soybean yields were up to 48% lower and grain corn yields were up to 17% lower than the averages for 2000-2005, excluding 2003, in St. Croix County as shown in **Table 24** below:

TABLE 24. Soybeans & Grain Corn Yields, 2000-2005
St. Croix County

Year	Soybeans	Corn (grain)
	bushels per acre average	
2000	44	140
2001	29	117
2002	49	150
2003	21	116
2004	32	137
2005	45	158
Avg. (w/o 2003)	40	140

drought year

source: USDA-NASS, Agricultural Statistics Database, <http://www.nass.usda.gov>.

At an average of $2.10 per bushel of grain corn from 2000 to 2005, a 24-bushel loss per acre would be equivalent to a $50.40 loss per acre. Given that 62,500 acres of grain corn were harvested in 2003, this is a potential loss of $3.15 million using the previous averages. However, this does not account for the 16,800 additional acres of grain corn which were planted but never harvested.

Soybeans experienced even greater losses. Even though 7,700 more acres of beans were planted in 2003 compared to 2002, the number of bushels harvested decreased by 47.6%. At a $5.71 per bushel average, these 715,400 fewer bushels of soybeans harvested in 2003 would be equivalent to a $4 million loss compared to 2002. Nineteen fewer bushels per harvested acre in yield at $5.71 per bushel would be an average loss of $108.49 per harvested acre of soybeans in 2003.

As discussed earlier, yields can vary greatly by location, with corn yields ranging as high as 200 bushels per acre in some areas to fewer than 100 bushels per acre in others during drought years. The lowest yields are located in the sandier and lighter soils of the County, which can be very difficult economically on those producers. During 2003, hay yields were also below average, driving up hay prices for livestock operators. Drought conditions can also result in the build-up of nitrates in feed and silage to levels that are toxic to cattle. In recent years, a small number of cattle in St. Croix County have died due to nitrate toxicity.

The far majority of local farmers understand and practice good management to reduce the vulnerabilities associated with drought conditions, but some knowingly take chances. Most farmers carry some type of crop insurance, especially in drought-prone areas. Most farmers also participate in Farm Service Agency programs which require multi-peril crop insurance and protects losses at average county yields. But such insurance is very expensive, and participation will often increase as the price received for the commodity increases. It is typically not cost-effective to insure low value crops, such as alfalfa.

As discussed earlier, drought conditions can also dry up private wells and ponds as well as impact surface and ground water levels. Under such circumstances, wells are often be re-drilled at significant cost; or a farmer whose livestock relied on a pond in the past may have to install a well and pump to provide water for stock. There is also some anecdotal evidence that heavy irrigation may be affecting some private wells north of Highway 64 as groundwater levels decrease. As surface waters decrease, contaminants and nutrients are concentrated which can further contribute to toxicity, eutrophication, or fish kills. And, as subsurface water levels recede, the underground pockets in the karst topography can grow, forming sinkholes, draining surface waters, or more quickly allowing contaminants from the surface to enter the aquifer.

Based on the key-informant interviews, historical events, and a review of the community, it was determined that the following general types of facilities and community assets are most vulnerable to extreme temperature events:

- Water utilities and private wells, under prolonged or extreme drought conditions
- Agricultural uses, especially in areas of well-drained soils

Crops losses, especially in sandy soils which are not irrigated, currently have the largest vulnerability due to drought for the County and represent the primary concern. In 2006, 77,500 acres of farmland were planted in grain corn, 41,300 acres planted in soybeans, and 8,500 acres planted in oats. The price-received value of the grain corn and soybeans alone is likely in the range of $18 to $20 million. All crops grown in St. Croix County are potentially vulnerable to the effects of drought.

And as irrigation continues and growth occurs, the potential impacts on groundwater supplies should be closely monitored in the future. Groundwater supply has the potential to become a larger concern during times of drought.

While drought's primary impact to date has been on agricultural yields, local agricultural officials and agents believe that tornadoes and high winds have historically been the largest cause of crop damage in St. Croix County over time, especially to corn and soybeans. However, the impacts of tornadoes and high winds on crop yields can be much more difficult to estimate and determine.

Vulnerable Critical Facilities

A complete assessment of the community's critical facilities and their susceptibility to drought is located in **Appendix F**. Overall, the vulnerability is low and most private and community wells appear to have excellent water quality and quantity to meet existing demand. However, there has been instances of private potable and irrigation wells drying-up during past drought events; these wells were then replaced with deeper wells. Groundwater levels should continue to be closely

monitored in areas near high-capacity wells, such as in the north-central portion of the county where a significant amount of agricultural irrigation takes place.

According to the St. Croix Electric Cooperative, unlike some areas further to the north in Wisconsin, the supply of electric service to St. Croix County residents has been adequate to meet overall demand during periods of prolonged or extreme heat. Over the last six years, the Cooperative has invested approximately $2 million per year in substation and line improvements to keep up with the demand.

Unique Jurisdictional Risks or Vulnerabilities—Drought

Overall, drought events pose few, if any, risks or vulnerabilities unique to individual jurisdictions as discussed in the *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G**. The level of vulnerability tends to increase with population size (and characteristics), agricultural uses within or adjacent to the community, and the capacity of water utilities. All communities reported good water quality and quantity which are not anticipated to be affected during times of drought based on local experiences in the past. Some municipalities are planning new wells to keep pace with new development.

v. Flooding

Risk Assessment--Flooding

The Hazard

Flooding is the only natural hazard with definable hazard areas within St. Croix County. As such, flooding receives the greatest level of analysis within this Plan.

Flooding is defined as a general condition of partial or complete inundation of normally dry land from the overflow of inland waters, or the unusual and rapid accumulation or run-off of surface waters from any source. Often, the amount of damage from flooding is directly related to land use. If the ground is saturated, stripped of vegetation, or paved, the amount of run-off increases, adding to the flooding. Additionally, debris carried by the flood can damage improvements and infrastructure, or can obstruct the flow of water and further contribute to flooding.

Generally for St. Croix County, flooding can be further subdivided into three primary types: (1) lake or riverine overbank flooding, (2) stormwater or overland flooding, and (3) flooding resulting from dam failure.

Lake or Riverine Flooding (Overbank Flooding)

Major floods in Wisconsin have, for the most part, been confined either to specific streams or to locations which receive intense rainfall in a short period of time. Flooding which occurs in the spring due to snow melts and/or a prolonged period of heavy rain is characterized by a slow buildup of flow and velocity in rivers, streams, or lakes over more than six hours and often over a period of days. This buildup continues until the river, stream, or lake overflows its banks for as long as a week or two, then slowly recedes. Generally, the timing and location of this type of flooding is fairly predictable and allows ample time for evacuation of people and property.

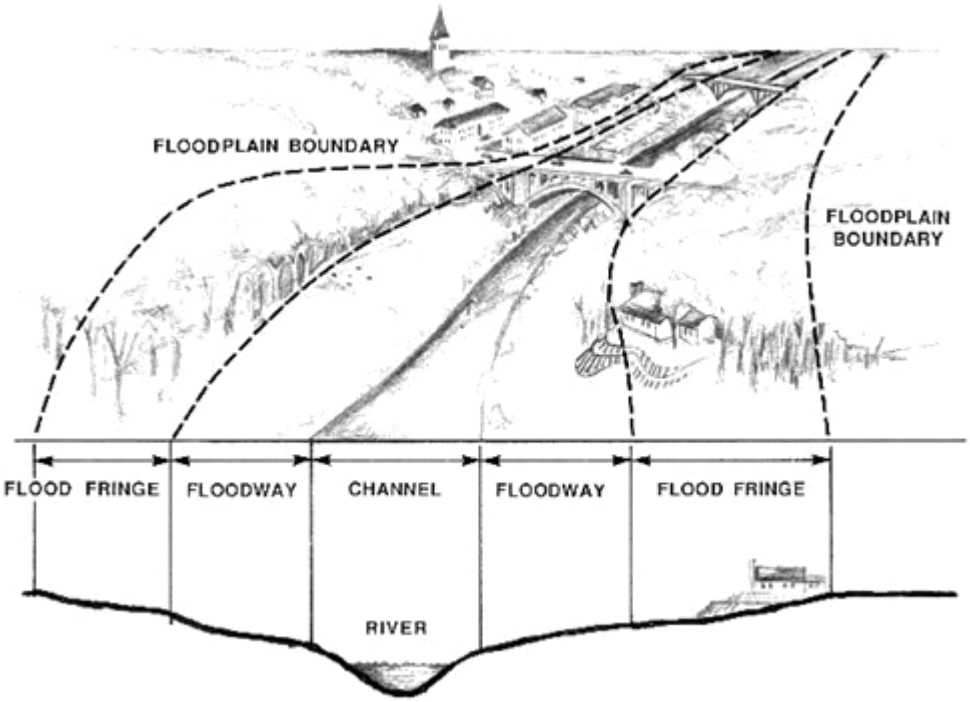
For regulatory purposes, the terms "100-year flood" and "floodplain" are commonly used. A **100-year flood**, often referred to as a **regional flood, special flood hazard area,** or **base flood**, is a flood that has a 1% chance of being equaled or exceeded in any given year. This can be misleading as a 100-year flood is not a flood that will occur once every 100 years. The 100-year flood, which is the standard used by most Federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance.

Key Definition
A 100-year flood has a 1% chance of being equaled or exceeded in any given year.

A **floodplain** is that land which has been or may be covered by floodwater during a flood event and includes the floodway and floodfringe areas (see **Figure 14**). The **floodway** is the channel of a river or stream and those portions of the floodplain adjoining the channel required to carry the regional flood discharge. Since it is associated with moving water, the floodway is the most dangerous part of the floodplain. The **floodfringe** is the portion of the floodplain outside of the floodway, which is covered by flood water during the regional flood and is generally associated with the storage of water rather than flowing water. The floodfringe is also that part of the

floodplain in which development may be allowed in some communities, subject to floodplain development standards.

FIGURE 14. Elements of a Floodplain



Source: Minnesota Department of Natural Resources.

The **regional flood elevation** is the elevation determined to be representative of large floods known to have occurred in Wisconsin or which may be expected to occur on a particular lake, river, or stream at a frequency of 1% during any given year. The **flood protection elevation** is an elevation which is 2 feet above the regional flood elevation as defined by the Wisconsin Department of Natural Resources. Development is sometimes allowed within the floodfringe if the structure is raised above the flood protection elevation. However, development in the flood fringe can decrease important floodwater storage; hydraulic analysis is often needed to ensure that the development will not result in increased flooding in adjacent areas or farther downstream.

Often, the term "floodplain" is used inappropriately by assuming that floodplains are limited to the 100-year floodplain boundary. This is not the case and a floodplain can be identified for a 500-year flood or other such level of risk.

The 100-year floodplain is a guide for regulatory and insurance purposes. Floods greater than a 100-year regional flood event can and do occur. Nationwide, approximately 1/3 of all National Flood Insurance Program claims are for structures outside the 100-year floodplain. This is a surprisingly high number, since many homes or structures outside the 100-year floodplain do not have flood insurance and flood insurance is typically not required by lending institutions for mortgages on structures not within the 100-year floodplain.

But this demonstrates that most properties are at risk of flooding to some degree. Generally, the 100-year floodplain should be considered the high flood hazard risk area. The 100-year floodplains are shown as the A zones on the FEMA Flood Insurance Rate Maps (FIRMs). Nationwide, 26% of the 100-year floodplains experience or exceed a 100-year flood event within a typical 30-year mortgage period. The 500-year floodplains (the shaded "X" zones on the FIRM maps) are the medium risk flood hazard areas. The remaining unshaded "X" zones on the FIRM maps should be considered the low risk flood hazard areas.

Also, high hazard flood areas can exist which are not shown on the Flood Insurance Rate Maps. And floodplains can change in hazard risk and size as development occurs or with other physical changes in the environment. Municipalities can take the initiative to have these added to the FIRM maps as a Letter Of Map Change (LOMC) or otherwise consider them during their planning and regulatory processes. Allowing inappropriately planned development to occur with knowledge of such potential hazards could be a source of potential liability for a community should a flood event occur which impacts the development.

Stormwater (Overland Flooding) and Flash Flooding (Overbank or Overland Flooding)

The type of flooding which occurs primarily from surface run-off as a result of intense rainfall is referred to as stormwater flooding or overland flooding. These flooding events tend to strike quickly and end swiftly. If 6" of rain falls on 2,000 square feet of roof and concrete (about the size of a typical roof, driveway, and garage), 1,000 square feet of stormwater will run-off from that single home.

Flash flooding is more difficult to distinguish and can, in fact, be either riverine (overbank) or stormwater (overland) flooding. In this Plan, flash flooding has been grouped with stormwater flooding due to its often unpredictable nature and the intense, rapid rise and velocity of the water levels. For prediction and warning purposes, floods are classified by the National Weather Service into two types: those that develop and crest over a period of approximately six hours or more, and those that crest more quickly. The former are referred to as "floods" and the latter as "flash floods." Like stormwater flooding, flash flooding is typically the result of intense rainfalls possibly in conjunction with already saturated soils, though very sudden snow melts can also contribute to stormwater or flash flooding.

Areas with steep slopes and narrow stream valleys are more vulnerable to stormwater and flash flooding, as the water can flow at a high velocity in a short time. Developed areas with substantial impervious surfaces can further contribute to stormwater and flash flooding. Flash floods often occur in smaller watersheds or are very localized and are, therefore, not shown on most FEMA Flood Insurance Rate Maps. Flash flooding can also be the result of dam failure.

Dam Failure (Overbank Flooding)

According to the FEMA Federal Guidelines for Dam Safety, dam failure is defined as a:

> "Catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. It is recognized that there are lesser degrees of failure and that any malfunction or abnormality outside the design assumptions and parameters that adversely affect a dam's primary function of impounding water is properly considered a failure. These lesser degrees of failure can progressively lead to or heighten the risk of a

catastrophic failure. They are, however, normally amenable to corrective action. (FEMA 148)."

Technically, dam failure could be considered a man-made hazard and, thus, outside the scope of this hazards mitigation plan. However, given the County's ownership and management of numerous dams in the Glenwood City area and the inherent relationship and similarities between dam failure and other types of flooding, a decision was made to include a discussion of this hazard as part of the flooding assessment.

Dam failure can occur from structural problems at the dam, hydrologic problems, malfunction of equipment, or human error in the monitoring or release of water. As such, dam failure can occur with little or no warning and on clear days with no rain, unlike the other types of flooding.

Older dams which have been poorly maintained have a larger potential of dam failure. Hydrologic problems may occur when there is heavy precipitation or snow melt, resulting in more water being impounded than by design or more than the spillway can handle, resulting in adjacent flooding, overtopping, or structural failure. A partial or complete failure of a dam can release great amounts of water, leading to loss of life and substantial damage downstream. A dam failure may lead to additional failures of other downstream dams.

Flooding from Groundwater Fluctuations

Somewhat unique to some northern and northwestern portions of the County (e.g., Bass Lake, Perch Lake, Village of Deer Park) has been the serious flooding from groundwater fluctuations. These groundwater fluctuations can vary significantly, causing surface waters levels at lakes or ponds to increase or decrease 10-15+ feet over a period of 10-20 years. Such fluctuations can contribute to both overbank or overland flooding, as well as underground seepage into basements. And unique to this phenomena, these fluctuations in water levels often rises or falls very slowly resulting in flooding or near-flood conditions for years at a time.

Regional Trends

Low-lying areas of those Wisconsin counties that border the Wisconsin and Mississippi Rivers and adjacent tributaries are prone to riverine flooding. Tributary rivers periodically flood in other places, including the Chippewa River and St. Croix River. As development has increased, agricultural flooding in some areas, such as in Waukesha County, has increased as well. Shoreline development has also increased both the risk and vulnerabilities to flooding. Since the 1960s, the number of homes along northern Wisconsin lakes has increased an average of 216%. Statewide, an estimated 250,000 structures lie within 100-year floodplains. Nationwide, floodplains have been slowly increasing in size due to increases in runoff and decreases in flood storage areas.

Flooding is the principal cause of damage in 17 of 26 Presidential Disaster Declarations in Wisconsin from 1971 through 2002. During the past decade, floods have been the most damaging weather hazard within Wisconsin, averaging $1.37 million in damages for each of the 396 reported flood events. The eleven largest Wisconsin flood events between 1990 and 2002 resulted in over $2.8 billion in damages and eight deaths.

There have been very few dam failures in Wisconsin that resulted in major damages or loss of life. Many of Wisconsin's approximately 3,800 dams are small logging or milling dams built

prior to 1900 and have little or no associated vulnerabilities. Between 1990 and 1995, more than 75 dam failures were documented in Wisconsin. Several of these incidents resulted in injuries and serious property damage, but no loss of life.

Relationship to Land Use

It is important to keep in mind the relationship of flooding to land use. Loss of natural flood storage areas, such as wetlands and floodplains, due to development, fill, or other such changes to the landscape can significantly contribute to local and regional flooding problems. Large areas of "hardscape", such as roofs, roads, parking lots, and other development, increases stormwater runoff, disrupts natural stormwater drainage systems, and can further contribute to local problems. This is especially pertinent due to the high rate of population growth and development in St. Croix County.

The 1995 U.S. Army Corps of Engineers *Floodplain Management Assessment* looked at such issues following the serious flooding in the region in 1993. For our region, the report found that decreasing upland runoff can have measurable benefits during large flood events. Further, it recommends a system-wide analysis to consider flood potential, reflecting that the benefits of certain improvements at one site, can be a detriment at another.

The *Assessment* further recommended better adherence to existing land-use policies (e.g., floodplain zoning) as an effective first step in flood mitigation and recommended that critical facilities be sited out of harm's way. The *Assessment* also warned against the trend that flood protection projects (e.g., dams and levees) have tended to induce floodplain development in many areas, seemingly foreshadowing potential problems such as those experienced with the recent levee failures in New Orleans.

Local Flood Events

Historically in St. Croix County, the most serious riverine flooding has been along the Willow and St. Croix Rivers. Older historical accounts tend to highlight the larger riverine floods where dams are washed out or homes, farms, or streets were damaged. The 2006 *Somerset Hazard Analysis* provides an excellent overview of the primary St. Croix County flooding occurrences:

Spring 1876	The Willow River flooded due to tremendous amounts of rain and melting snow, threatening New Richmond. *(New Richmond News, April 11, 1931)*
December 1886	The Willow River flooded Hudson in a rare winter flood. *(New Richmond News, December 12, 2002)*
April 1897	Floodwaters backing-up from the Mississippi River flooded Hudson. *(The Hudson Star Observer, 125th Anniversary Edition, June 21, 1979)*
March 1928	A large flow of water along with some ice chunks damaged the Willow River dam located at Roller Mills in New Richmond. *(New Richmond News, March 28, 1928)*
April 1934	A flood damaged much of the Roller Mills plant in New Richmond. *(New Richmond News, April 4, 1934)*
Spring 1936	The Willow River flooded all over St. Croix County, washing out roads in both New Richmond and Star Prairie. *(New Richmond News, March 25, 1936)*

April 1952	The St. Croix River stood at 689.48 feet above sea level, the highest level in recorded history up until then.
Spring 1965	Heavy rainfall resulted in major flooding as the St. Croix River reached a record 694.07 feet above sea level. An emergency dike was erected in nearby Stillwater.
April 1965	A dam on the Apple River crumbled to the pressure of a five foot high wall of water. *(New Richmond News, April 22, 1965)*
Spring 1966	Major flooding again occurred on the St. Croix River *(A Century of Service – American National Red Cross – 1881-1981, published May 1981)*
April 1967	The Willow River flooded the streets of New Richmond. *(New Richmond News, April 6, 1967)*
April 1969	St. Croix River reached 692.32 feet above sea level. An estimated 3,000 people from Bayport and Afton, Minnesota were evacuated.
Spring 1989	The Willow River flooded and washed into streets and homes of New Richmond. *(New Richmond News, March 30, 1989)*
Spring 1997	Flooding on the St. Croix River required nearby Stillwater to create an emergency dike.
April-May 2001	The St. Croix and nearby rivers were severely flooded. The Stillwater Lift Bridge was closed from April 10th into May. Debris accumulated at the Kennedy Mills Dam on the Apple River causing an adjacent embankment to collapse. *(National Weather Service)*
August 2001	Heavy rainfall caused flash flooding across much of St. Croix County. Many roads were under water and damages were estimated at $200,000. *(National Weather Service)*

In all, the *Somerset Hazard Analysis* notes that six floods have occurred in St. Croix County between 1982 to 2006. This more recent flood history can be supplemented using the National Climatic Data Center flood data available from 1993 to 2006 as shown in Table 25 which identified seven flooding events in the County between 1993 and 2006. It should be noted that the property damage total for the regional event occurring in April 2001 includes damages experienced outside the County. Damage estimates often go unreported or underreported in the NCDC database. Further, damages which are covered by private insurers or by Federal crop insurance are also many times not reported in the NCDC database.

TABLE 25. NCDC Documented Flood Events (NCDC data from 1993-2006) St. Croix County

Location	Date	Time	Type	Deaths	Injuries	Property Damage
Regional	4/6/1997	06:00 AM	Flood	0	0	0
Regional	4/1/2001	12:00 PM	Flood	0	0	$12,280,674
Regional	5/1/2001	12:00 AM	Flood	0	0	0
Countywide	8/1/2001	08:00 AM	Flash Flood	0	0	$245,614
Hudson area	6/25/2003	12:00 AM	Flash Flood	0	0	0
River Falls area	7/8/2005	7:30 PM	Flash Flood	0	0	0
River Falls area	10/4/2005	9:00 PM	Flash Flood	0	0	0
Totals:	**7 events**			**0**	**0**	**$12,526,288**

source: National Climatic Data Center (NCDC) 1993-2006; Damage estimates in current dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

The NCDC data and the history of flooding events included in the County and Somerset hazard analyses provide some significant flooding trends for St. Croix County which were further confirmed by local officials and other sources during the mitigation planning process:

- No deaths or serious injuries related to flooding events were noted in the sources researched. Historically, death or injuries were not uncommon in the region, in particular due to log jams during the logging days or the washout of roads, bridges, or railroads, but no such injuries were noted for St. Croix County, though some likely occurred in the distant past.
- Historically, flooding on the Willow River, especially in the New Richmond area, has been a significant problem. However, improvements to the dams on the Willow River, including the Mill Pond Dam in New Richmond, have helped to mitigate these problems. Large areas of floodplain along the Willow River have also been acquired for public lands, also helping to mitigate potential flooding.
- St. Croix River flooding is worst when flooding on the Mississippi River occurs and floodwaters back-up the St. Croix River. These floodwaters can even overtop the Lake Mallalieu Dam between Hudson and North Hudson, causing flooding problems along the lakeshore, especially the north side.
- Since the 1950s, St. Croix River flooding has had more serious impacts on the Minnesota side of the river. In St. Croix County, North Hudson, Hudson, and the Town of Troy have been most acutely impacted, though the 100-year floodplains are relatively small in these communities and impacts are typically limited to certain areas or a small number of structures. Significant mitigation activities since the mid-1960s, such as the construction of dikes or installation of rip-rap, have mitigated some of the more serious St. Croix River flooding impacts in the County.
- In recent years, stormwater or flash flooding has been noted as a more significant concern, occurring every other year on average, with multiple events in some years. And unlike riverine flooding, there is a greater of chance of experiencing stormwater flooding during a non-spring month. Stormwater flooding impacts are also not limited to

floodplains, with significant damage typically occurring to local roads, shoulders, and culverts.

- Though stormwater or flash flooding can occur countywide, the most significant events and damage during the last decade have occurred in the southern tier of towns and the River Falls area.
- The County has few large areas of 100-year floodplain on a major river, such as the Chippewa River bottoms in southeast Dunn County, so agricultural and crop damages due to riverine flooding has not be a significant issue in the County. Instead, stormwater or flash flooding has been a more significant problem for crops, such as in 1993 when over $8.5 million (adjusted for inflation) in crop damage occurred in the County.
- Based on the NCDC data since 1993, a flood event has occurred in the County every 1.8 years on average, with stormwater or flash flooding being an increasingly reported occurrence.
- There is also a recent trend based on the NCDC data of more than one flood event occurring in a single year, perhaps due to prolonged weather patterns combined with saturated soils and with flood storage areas which have not returned to normal conditions from a previous flood event.

Between 1969 and 2002, St. Croix County was part of five Presidential disaster declaration requests involving flooding: 1969, 1971, 1980, 1993, 1998, and 2001, with the 1971 and 1970 requests denied.

The 2001 flooding event caused the most flood damage in St. Croix County since the floods of the 1960s. The flooding was the result of heavy snow fall during winter remaining on the ground through the end of March and then rapidly melting, resulting in river stages close to record levels along Wisconsin's western border. Water began to gush through drainage ditches, streams and into the mainstem rivers during midday April 1. Two to four inches of rain fell on April 7-9 which prolonged the high water and also added about one foot to the crest during mid-April. Another two to three inches of rain April 22-23 caused a second crest in late April. Both the St. Croix and Mississippi Rivers remained well above flood stage into May.

Approximately $160,000 in damage assistance requests were made under the Federal Disaster Declaration by St. Croix County governmental entities for the 2001 flood. Of this damage, 54% was related to the repair of road, shoulder, and culverts. Another 37% of the damage was to park and trail facilities in the City of Hudson, Village of Somerset, and at Troy Beach County Park, reflecting that local governments have mitigated potential flood damage by using many high-risk floodplains for low-intensive recreational uses. It is believed that many local municipalities did not submit damage assistance requests for their local costs related to debris cleanup or relatively minor road repairs. And some facilities, such as the YMCA Camp, experienced significant damage but was not eligible for federal assistance.

Smaller, but still serious flash and stormwater flooding events occur more frequently and tend to be a more significant issue for improvements near the smaller streams and drainageways of the County which may not have areas available to retain flood waters. In recent years, these flash flood events have been reported annually, if not twice per year in some areas. Such flood events are largely the result of very heavy rains in a short period of time and can be relatively localized

in impact. Damage to structures tend to be less per event than the larger riverine floods, but can place near-constant demands on local municipalities and landowners to maintain and improve local roads and properties to repair damages and mitigate potential future impacts.

One such "smaller" flash flood event was experienced in June 1993 due to heavy rains. This event is not reflected in either the NCDC database or *Somerset Hazard Analysis*, and St. Croix County did not experience the full force of this storm, compared to Eau Claire, Clark, and Jackson Counties. According to the "*Long Term Flood Recovery Plan*" completed by West Central Wisconsin Regional Planning Commission in April 1994, an estimated $8.6 million in estimated direct damages (adjusted for inflation) to residential properties, agriculture, business, industry, and tourism occurred in St. Croix County as a result of the June 1993 flooding. This is a surprisingly high amount of damage, given that this storm event does not appear in the NCDC records. However, for St. Croix County, almost 99% of this damage was due to crop losses, based on Wisconsin Department of Agriculture data.

The County has had no significant flooding due to dam failure since the mid-1960s. The Huntington Dam on in the Apple River in the Town of Star Prairie which had caused some problems in the past was removed in 1965. Washouts on older dams were not uncommon prior to 1970 (e.g., Upper Burkhardt Dam abt. 1920; Prairie Mills Dam abt. 1950s), but dams are much more closely regulated and monitored today. Based on interviews with Wisconsin DNR and local officials, all significant and high hazard dams in St. Croix County are in good structural conditional, with many undergoing structural improvements within the last 20 years. Failure of these dams should not occur.

National Flood Insurance Program Claims and Repetitive Loss Properties

In total, there have been twelve (37) National Flood Insurance Program (NFIP) claims involving 24 properties for St. Croix County. The largest concentration of these claims (14 claims on 6 properties) can be found in the Bass Lake area. The second highest concentration (7 claims on 4 properties) can be found in the Cove Road area of the Town of Troy on the St. Croix River, which includes the County's only two repetitive loss properties. For incorporated areas, the largest concentration (4 claims on 4 properties) in the City of New Richmond along Riverside Drive on the north side of the Mill Pond.

Repetitive loss properties are those properties participating in the National Flood Insurance Program (NFIP) that have filed two or more claims of $1,000 or more in a 10-year period. This list is regularly compiled by FEMA and made available to the Wisconsin Division of Emergency Management.

Two properties in the County are on the repetitive loss properties list. Both properties are located along Cove Road in the Town of Troy and both had claims related to the 2001 flood. One of the homes has had two building claim payments totaling $31,866, about 18% of the total building value. The second home has had two building claim payments and a contents payment totaling $45,302, about 35% of the total building value.

The St. Croix County NFIP claims are summarized in **Table 26** below. As the table shows, over 40% of the claims are, perhaps unexpectantly, along two lakes in the western part of the County. As will be discussed in the next section, the flooding at these two sites have been more a problem with fluctuating groundwater tables in the past, rather the typical riverine or stormwater

flooding. Only 30% of the claim have been for properties along the St. Croix River, though the flooding has been very serious at times resulting in the two repetitive loss properties. And only 16% of the claims have been along the Willow River, the majority from a single event impacting a neighborhood on the north side of the Mill Pond in the City of New Richmond which may have been largely mitigated through more recent improvement to the dam according to local officials.

TABLE 26. Location of National Flood Insurance Program Claims St. Croix County

Location of Claim	# of Claims	# of Properties
Bass Lake Area	14	6
Perch Lake Area	2	2
Town of Hudson (Willow River)	1	1
Town of Troy (St. Croix River)	7	4
Town of Richmond (Willow River)	1	1
Town of Somerset (Apple River)	1	1
Village of North Hudson (St. Croix River)	1	1
City of Hudson (St. Croix River)	3	2
City of New Richmond (Willow River)	4	4
City of River Falls (Kinnickinnic River)	2	1
exact location not determined	1	1
Totals	**37**	**24**

Relative Level of Risk

Flooding in St. Croix County will continue to be a significant risk for County residents and improvements. A smaller overland or stormwater flood event can be expected to occur annually in some areas, with multiple events in a single year not uncommon. These events will primarily result in basement flooding, washing out of road infrastructure, and contributing to soil and bank erosion.

Based on the seven (7) flooding events which have occurred over the past thirteen (13) years in St. Croix County, it is likely that St. Croix County will continue to experience one serious flood event every 1.8 years on average. Some of these events may be localized in nature only impacting a portion of the County, while multiple events may be experienced in the same year or even month. The larger, riverine flooding events will most frequently occur in the spring months of late March through early June, when snows melt, soils are saturated, and/or heavy spring rains occur. Ice damming on rivers and drainageways can further exacerbate such flood conditions. Stormwater or flash flooding events can occur any time of year with impacts which may not be limited to high-risk floodplains. Damage to crops from these events can be significant, especially due to erosion or pooling of stormwater runoff.

Less frequent will be the larger, severe flooding events which cause significant damage for which federal assistance will be pursued. Based on past disaster declaration requests, these more severe flooding events will occur once every 5.5 year on average. Historically, the far majority of these large, severe floods occurred during the months of April through July and will likely have characteristics similar to the Spring 2001 floods resulting from significant snow melts in a short period combined with heavy rains.

If the dams within St. Croix County continue to be well maintained, flooding related to dam failure should not occur and is not expected. In fact, most of the smaller, privately owned dams would cause very minimal or no damage downstream, if a failure should occur. The larger dams with significant or high hazard ratings were built to strict engineering standards, have related emergency plans, and are closely monitored.

In considering all hazards facing St. Croix County, the Steering Committee ranked flooding as a moderate risk, behind most hazard types within this Plan's scope. Overbank and river flooding ranked as the highest flood risk with a 2.67 out of 5.0 ranking. Stormwater and flash flooding had a slightly lower risk rating of 2.33 and the risk of dam failure was considered relatively low at 1.67.

These rankings are consistent with the flood history of St. Croix County with the most significant, damage-causing flooding events occurring along its rivers, as opposed to overland or stormwater flooding. However, this perception may not reflect actual crop losses due to stormwater flooding which often go under-reported.

And, these relative ranking are subject to change. In recent years, reported incidents of stormwater flooding have been increasing as reflected in the NCDC data. This is in part due to improvements in reporting. But, stormwater flooding may also be an increasing concern due to increased stormwater runoff from development, combined with the riverine flood mitigation activities of the last 30 years which have decreased overbank or riverine flooding problems (e.g., increased flood storage in some areas, use of floodplains as parks, dike construction, dam improvements).

Vulnerability Assessment – Flooding

Flooding can be the most destructive of hazards, affecting large areas for long periods of time. Since flooding is tied to topography, a substantial amount of flood damage is the result of basement flooding, though floods can also move or destroy entire structures. Deaths and injury are relatively rare in the region with river and lake flooding, since adequate warning time is usually available, though flash floods or dam failures can be very deadly as they may form very swiftly. Serious injury or death can occur when travelers are unaware that a road or bridge has been washed out, or an attempt is made to cross a flooded roadway.

Floods can also hinder the flow of traffic and can cause havoc to water supply and wastewater treatment systems. The 1993 flood caused significant nitrate, coliform, and triazine contamination problems in many private wells in nearby Dunn County. Nitrate and triazine contaminates exceeded the "preventive action exceedence" standard in 54.7% and 5% of the wells tested in the flood area, respectively. Coliform was detected in 27.1% of the tested wells.

Debris carried by flooding can result in direct damage to bridges, structures, or property; or this debris can obstruct the flow of water causing additional flood damage, similar to the historical experiences with log jams in the 1800s and early 1900s. When floodwaters enter structures, the resulting moisture build-up (HVAC systems, carpeting, drywall, etc.) can cause additional, long-term health problems with mold and mildew once the floodwaters have retreated, or leave

environmentally hazardous residue from gas, oils, sewage, and similar contaminants which were released during the flood event.

Approximately 42% of reported damages from Wisconsin floods between 1993 and 2000 were from crop damages. For the 1993 flood in St. Croix County, about 99% of the reported damages were to crops, primarily due to severe stormwater runoff and ponding in fields. According to the U.S. Army Corps of Engineers 1995 *Flood Management Assessment*, about 80% of the crop damages in the region were due to overly saturated fields and stormwater runoff, and not associated with overbank flooding. The Assessment goes on to recommend crop insurance as the best method to mitigate the impacts of this crop damage. Crop insurance programs were reformed in 1994 to increase access and use of the pre-pay insurance program, rather than relying on disaster assistance to cover such damage.

The High Hazard Floodplain Areas used in this analysis may differ from the official 100-year floodplain.

Flooding can have additional agricultural impacts as well. Loss of forage crops (e.g. alfalfa) require many farmers to supplement feed for livestock, which can cost as much as $1,500 per month for a dairy cow. Due to the low value of forage and high insurance costs, most farmers do not have multi-peril crop insurance for forage crops. The remaining forage in flooded areas can be lower in quality, reducing milk production and complicating or reducing pregnancies and births. Feed and water quality problems which result in sick animals also increases veterinary costs. And the impacts can be long-term. The harvesting of crops in wet areas can compact soils, further reducing crop yields for years to come. As impacted farmers reduce purchases or quit farming all together due to such challenges and financial stress, local businesses and the farming economy are also affected (e.g., implement dealers, feed stores, graineries, food processing, banks, general goods). To compensate, the costs for such services may also be increased, or the local businesses may close, further burdening the remaining farmers in the area.

Identifying the High Hazard Floodplain Areas

During the planning process, local officials expressed concern over the accuracy of the FIRM maps for St. Croix County. Most of the FIRM maps have not been updated since the 1980s. A FIRM map modernization project is currently underway which should further increase the accuracy and usability of the FIRM maps, but these updated maps are currently under review with some significant corrections yet to be made. These new FIRM maps will likely not be available before early 2008.

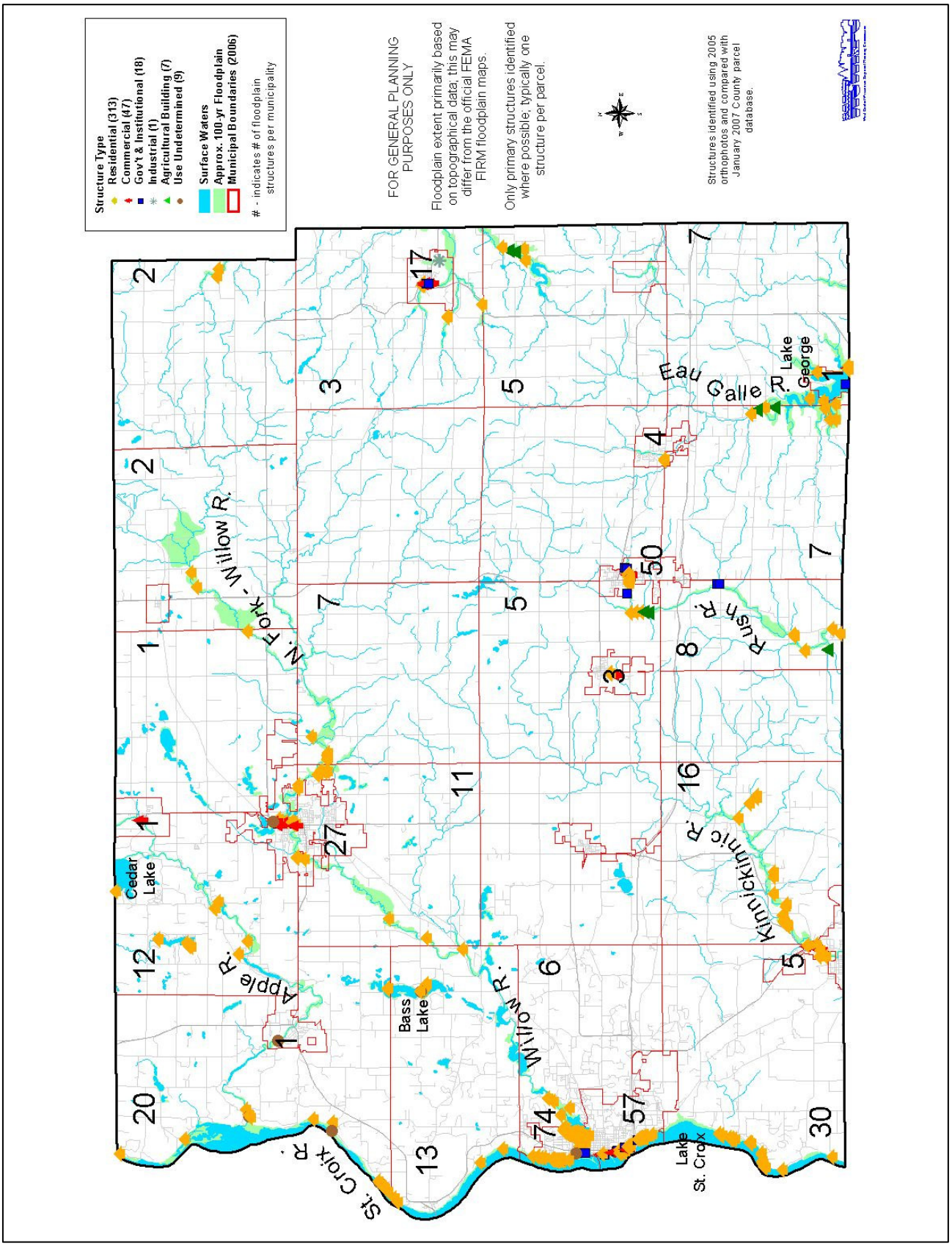
To overcome these challenges, the existing FEMA FIRMs were digitized by West Central Wisconsin Regional Planning Commission (WCWRPC) using the methodology discussed in Appendix B. Since the older FIRM maps are essentially "stick-type" drawings, adjustments were made to the FIRMs so that they better fit river corridors as shown on orthophotos and available topographic information. The result of this alternative approach is a map representation of the **high hazard floodplain areas** for St. Croix County. While perhaps resulting in a more realistic representation of the high hazard floodplain areas, this approach did create discrepancies when compared to the 100-year floodplain boundary as shown on the official FEMA FIRM maps.

This high hazard floodplain area representation has been used in past County planning efforts as a substitute for the official 100-year floodplain. To remain consistent, it is also being used

within this flood assessment, amended to include the Village of Baldwin revised 100-year floodplain which was recently updated by the community. With the next update to this plan, the new FEMA D-FIRMs should be used for this flood analysis.

Figure 15 identifies the high hazard floodplain areas within St. Croix County. Again, the high hazard floodplain areas are based upon and are generally very similar to the official 100-year floodplains, but differences exist in some areas. For general planning purposes, the high hazard floodplain areas are considered as being an approximation of the 100-year floodplains for St. Croix County, but the high hazard floodplain map should not be used for floodplain zoning or flood insurance determination purposes.

FIGURE 15. High Hazard Floodplain Areas & Potentially Floodprone Structures St. Croix County



Development in High Hazard Floodplain Areas

Figure 15 also shows the location of principal structures likely located partly or wholly within the high hazard floodplain areas based on available information. This map was created using ArcView geographical information system (G.I.S.) technology using orthophotography and 2006 St. Croix County parcel line data as described within the flood assessment methodology in Appendix B. Generally, only one principal structure was identified per parcel and accessory structures in the floodplains were not identified.

Based upon best available information,[14] a total of 395 structures in St. Croix County may be located within a high hazard floodplain area. As Figure 15 shows, the far majority of these structures (79%) were residential uses and only 12% were commercial uses. Only one industrial structure in the high hazard floodplain area was identified, that being located in the City of Glenwood City.

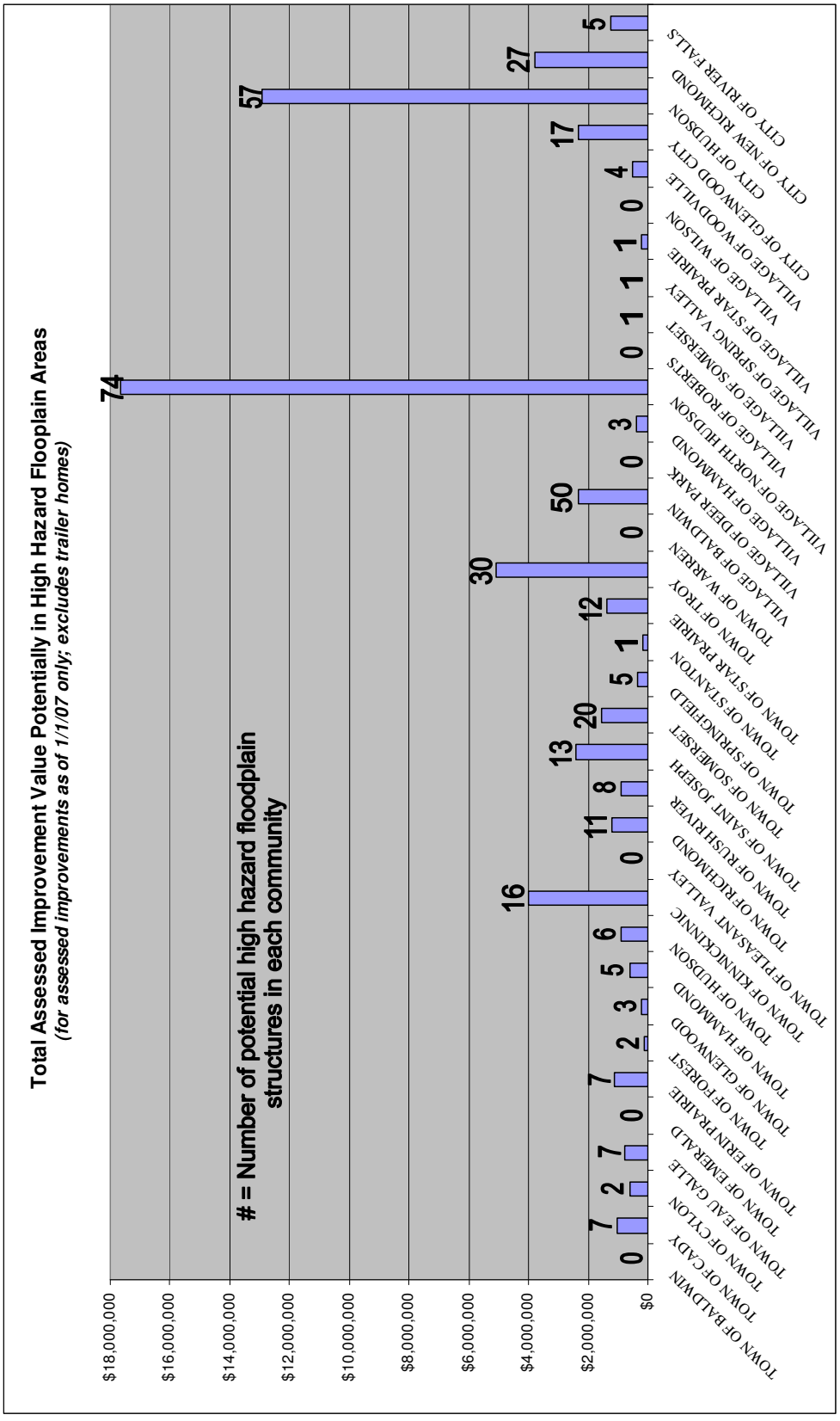
The total assessed value by municipality of these structures potentially in high hazard floodplain areas are shown in **Figure 16**. As the graph shows, the majority of potentially high hazard structures (61%) are located within the incorporated cities and villages, with the largest concentration (19%) within the Village of North Hudson. Nearby City of Hudson had the next highest concentration at 14%.

In total, over $63.8 million in assessed improvements were identified as potentially being located within the high hazard floodplain areas of St. Croix County based on the St. Croix County tax assessment database as of January 1st, 2007. The largest concentrations of these improvements can be found in the Village of North Hudson, City of Hudson, and Town of Troy as shown in Figure 16. While the Village of Baldwin has a relatively high number of potential high hazard structures, most of these were mobile homes which are not reflected in the tax assessment database. The assessment data also does not include non-taxable buildings and infrastructure, such as churches, government buildings, and municipal utilities.

It must be noted that **the structures identified on Figure 15 and represented in Figure 16 may not have had flooding problems in the past and may not have a high risk of future flooding**. This data and approach is not without its weaknesses. First, this analysis uses a two-dimensional, "bird's-eye perspective" and does not consider localized topographical or elevation changes which might not be reflected on the FEMA FIRM maps. Existing FIRM maps typically do not have base flood elevations for 100-year floodplains in the rural areas of the County. Elevation and structural data for the individual buildings is also not available. For instance, a home may be elevated above flood levels on a small knoll or on a built-up building site, and be technically out of the floodplain, though this would not be apparent using the available information. Further, we cannot be certain of the types of structures identified, including the lowest floor elevation of the structure and whether the structure has a basement or multiple stories. In some cases, only a portion of a building and its contents would be vulnerable to flooding, but we cannot make this distinction without detailed elevation and structural data which is currently not collected in St. Croix County.

[14] Failure to identify a structure in Figure 16 does not necessarily ensure it is above the regional flood elevation or outside the 100-year floodplain. Nor does the identification of a structure here provide the exact information necessary to be certain of a structure's location or elevation within the floodplain. See Appendix B.

FIGURE 16: Total Assessed Improvement Value Potentially in High Hazard Floodplain Areas



Unincorporated Areas Prone to Flooding

Given the lack of accurate data for the elevation of specific structures relative to the base or regional flood elevation, the flood assessment was further supplemented through local meetings, a survey to Town Boards, and key-informant interviews with County officials. This allowed for the identification of other flood vulnerabilities, such as potentially vulnerable infrastructure or unique environmental features. This information was also analyzed in the context of available reports and NFIP claim data.

This research yielded that riverine flooding over the past 25 years in unincorporated St. Croix County has typically been most frequent and severe along the St. Croix River, Willow River, and some lower-lying lands along the Apple River. Flash flooding and overland flooding is more frequent however and can occur Countywide, though it has been a more significant problem recently in southern portions of the County. Somewhat unique to the County are the instances of flooding related to fluctuating ground water levels, especially in northern and western portions of the County (e.g., Deer Park, Bass Lake, Perch Lake).

In St. Croix County, riverine flooding has the largest potential to cause serious damage to many structures as part of a single event, though severe events are very infrequent and there is typically time available to prepare for such an event to mitigate potential damage (e.g., evacuation, sandbagging). More frequent stormwater flooding causes less severe damage to structures overall, mainly causing problems for basements, yards, and garages, but often contributes to costly road damage and significant crop losses. Overbank and overland flooding related to rising groundwater tends to be on a 10-20 year cycle and has also caused significant damage to structures, but its effects tend to be more localized in nature.

Figure 17 shows those areas most prone to flooding and of potential flooding concern in St. Croix County with each area further described below:

- The Cove area along the St. Croix River in the Town of Troy experiences riverine flooding to various degrees almost annually during times of spring melt. During the past twenty-five years, the worst flood damage has occurred when flooding downstream on the Mississippi River caused floodwater to backup on the St. Croix River. The second highest concentration of National Flood Insurance Program (NFIP) claims in the County can be found in this area, as well as the County's only two repetitive loss properties.

  The Cove neighborhood is an area of lakefront cottages, many of which have been renovated or replaced in recent years for bigger, year-round residences. In some cases, the steep, rugged topography in the area has limited home development to flatter sites closest to the river. Due to the high value of many of these homes and the prime location, the buyout and removal of floodprone homes in this area may not be a feasible alternative.

- Troy Beach County Park/YMCA Camp. Flooding of the beach area of the Troy Beach park and YMCA camp occurs approximately once every 3-5 years. Typically, debris must be cleared from the beaches or parking lots and some bank erosion occurs, but serious damage is rare. The more severe 2001 flood did cause some significant damage however. At Troy Beach, waves ripped off the roof to the bath house, while boats, deck supports, and other equipment were damaged at the YMCA Camp. Both facilities have minimal improvements in the floodplain and limit equipment storage in the high hazard floodplain during flood seasons. No mitigation efforts are planned or needed at this time at these locations.

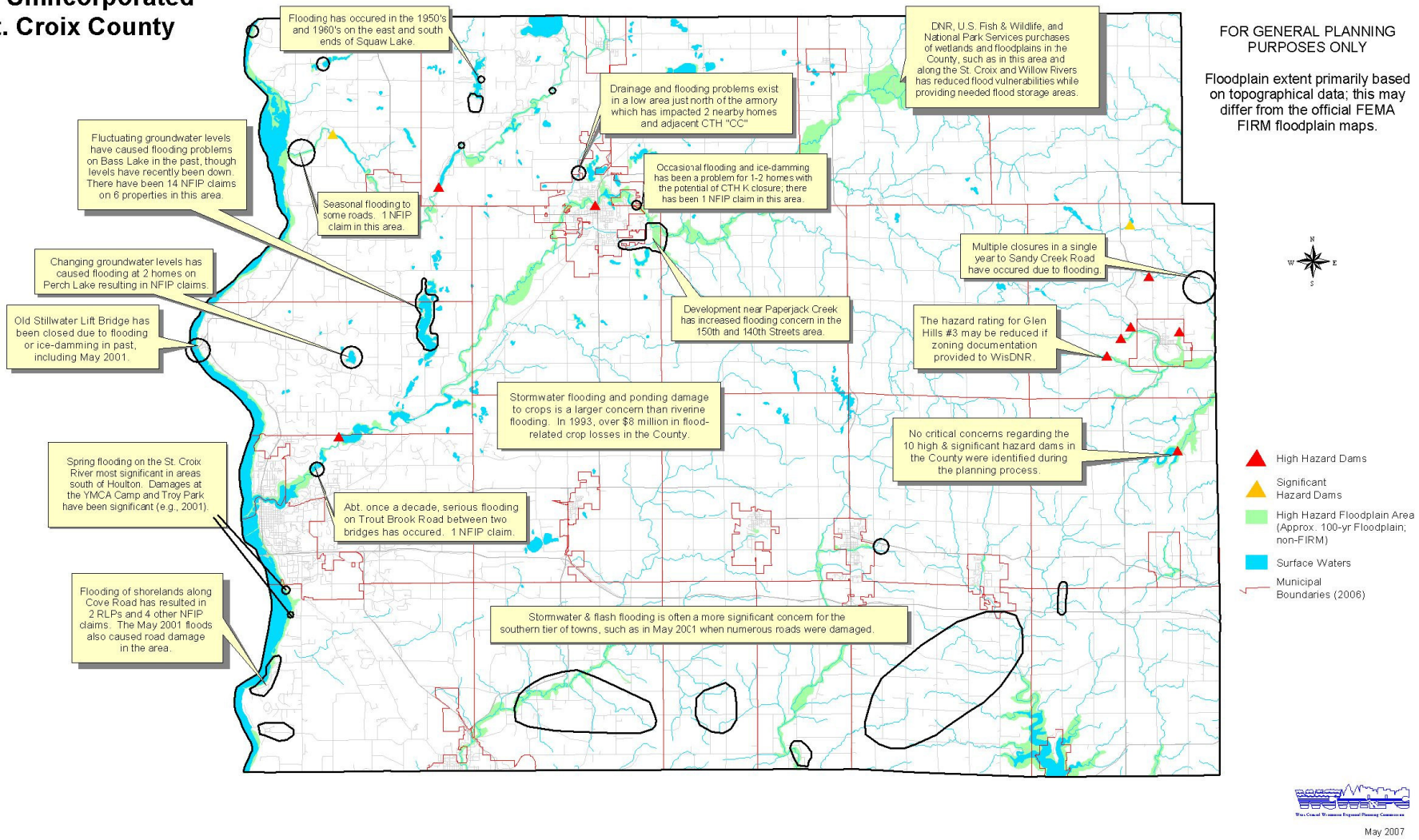
- The Houlton/Stillwater Lift Bridge over the St. Croix River has had major flooding problems in the past. Due to the low elevation of the bridge, debris can accumulate and ice-damming can occur on the upstream side, further contributing to problems and flood conditions. On occasion, conditions were such that a potential washout of the bridge was feared. In 2004, the bridge carried 16,700 vehicle trips in an average day. As discussed in the transportation subsection at the beginning of this report, a new bridge for vehicular traffic should be constructed in the next five to ten years, largely mitigating this concern. However, the existing historic lift bridge will be retained for pedestrian and recreational use, and will still be vulnerable to flood and ice dam damage.
- Slowly fluctuating groundwater levels have historically been a flooding problem for homes at Bass Lake in the Towns of St. Joseph and Somerset. A total of 14 NFIP claims have been made for six properties on Bass Lake, making it the highest concentration of claims in the County. Groundwater levels have historically cycled, reaching an all-time high in 1998, but are 4 to 5 feet lower now; levels have been as much as 10 to 15 feet lower in the past. In the 1990's, a lake rehabilitation district was established and an extensive pumping effort undertaken to reduce waters. Water levels retreated very soon thereafter, apparently not due to the pumping itself. There has been some speculation that removal of dams on the Willow River in the late 1990s may have helped lower groundwater levels in the area. Drier weather conditions and normal groundwater cycles may have also contributed to the lower levels.
- Similar groundwater fluctuations have been worse in the past at the nearby, smaller Perch Lake in the Town of St. Joseph, though fewer homes have been impacted. Water levels have been 3' to 4' up the sides of cabins for years at a time. Up to three additional homes have become flooded or landlocked during flood conditions and one owner recently filled in their basement as a means of floodproofing. Unlike riverine flooding, the cause, trends, and solutions for these fluctuations are more difficult to determine. Though conditions at Perch Lake have temporarily improved, long-term water levels remain uncertain and some lakeshore structures remain floodprone. There may be potential to mitigate these concerns through acquisition of floodprone properties which would also allow for the relocation of the boat landing for much safer lake access.
- Trout Brook Road (or Rustic Road 13) where it crosses the Willow River bridge in the Town of Hudson overflows about once every decade. A small number of nearby homes are potentially in the floodplain and there has been one NFIP claim from this area.. An engineering study of the area's hydrology is needed to consider options for improving drainage and reducing flooding potential.
- Portions of the lower Apple River in the Town of Somerset have been subject to seasonal riverine flooding in the past, but impacts to structures have not been significant overall and limited to one NFIP claim. A few roadways in the Town also have occasional riverine flooding problems.
- Historically, there has been flooding on the south and east ends of Squaw Lake in the Town of Star Prairie, but not since the 1950's and 1960's has this occurred. Significant residential lakeshore growth has occurred in the interim which could become a problem should flooding return. This flooding may be related to fluctuating groundwater levels.
- Also in the Town of Star Prairie, drainage and stormwater flooding problems exist near the northwest side of the City of New Richmond which has impacted 2 nearby homes and

adjacent CTH "CC" in the past. Drainage patterns in the area have been disrupted by development and potentially the new Highway 64, further contributing to ponding just north of the Armory. Additional parking lots in the area adds additional stormwater runoff. The most significantly impacted home has been floodproofed by the owner. A proposed recreational park to the northeast may offer opportunities to reduce stormwater runoff to this area.

- Flooding and ice-damming has been periodic problems for 1-2 homes along the Willow River in the Town of Richmond. The flooding been the biggest concern just east of the City of New Richmond and just south of CTH "K". There has been 1 NFIP claim in this area in the past and closure of the County Highway has been threatened. Dynamite has been used on occasion to break up the ice damming and reduce flooding potential.
- Southeast of the City of New Richmond in the Town of Richmond, development near Paperjack Creek has increased runoff and flooding concerns in the 140th and 150th Streets area and has the potential to impact homes should a serious flood occur, such as during a quick snow melt combined with heavy spring rains.
- It is not uncommon for Sandy Creek Road in the Town of Glenwood to experience floodwaters over the roadway multiple times in a single year from Sandy Creek.
- Southern parts of the County, such as in the Kinnickinnic and Rush River basins, have had high incidences of road and culvert washouts due to stormwater flooding, but such road and embankment damage is not limited to this area. Generally, there are fewer large public-owned flood storage areas in these river basins which may be contributing to these stormwater problems, as compared to the northern and western parts of the County.
- Overland stormwater flooding and ponding damage causes significant crop losses and can have many additional indirect impacts on the agricultural economy, though these losses are sometimes not readily apparent to the general public. In 1993, over $8 million in estimated crop losses (*adjusted for inflation*) directly due to flooding were experienced in St. Croix County.

It should be noted that many floodprone and high hazard floodplain areas are now in public parks, recreational uses, or wildlife lands and are not of significant concern. This not only reduces potential vulnerabilities by preventing floodplain development, but has reduced risk further downstream by providing flood storage areas which reduces the frequency or magnitude of flood events. The Wisconsin Department of Natural Resources, U.S. Fish & Wildlife, and National Park Services own significant amounts of floodplain land on the St. Croix and Willow Rivers. In addition, the Army Corps of Engineers owns large amounts of floodplain near along Lake George and the Eau Galle River. Many local municipalities and the County have also maintained floodprone properties for recreational uses, such as Troy Beach County Park and numerous community parks.

FIGURE 17.
Areas of Flooding Concern in Unincorporated St. Croix County



May 2007

Critical Facilities in Areas of Flooding Concern

As the critical facilities vulnerability assessment in **Appendix F** discusses, critical facilities located in floodplains are primarily limited to infrastructure (e.g., roads, bridges, dams).

Using geographic information system technology and orthophotography, we are able to compare the location of most critical facilities in St. Croix County to the high hazard floodplain areas. Using this process, portions of two critical facilities were identified as potentially being located within a high hazard flooding area:

- City of Hudson Wastewater Treatment Plant
- Greenfield Elementary School -- Baldwin School District

Neither of these facilities have had significant flooding problems in the past. Utility distribution systems in some small, localized areas have had flooding problems in the past however, such as a lift station along Lake Mallalieu in the Village of North Hudson or the infiltration of floodwaters into septic lines in the Village of Deer Park. Such concerns are discussed in the next subsection on unique jurisdictional risks or vulnerabilities. And, as identified in the previous subsection, some localized flooding concerns have impacted transportation systems in the past, including the Stillwater Lift Bridge.

No extremely hazardous substances planning facilities are believed to be located within a high hazard floodplain area within St. Croix County.

Unique Jurisdictional Risks or Vulnerabilities—Flooding

The number and value of structures potentially within the high hazard floodplains areas of each incorporated community was previously discussed in this flood assessment (see Figure 16 and Figure 16). Those communities with NFIP claims were also previously identified. This subsection briefly discusses the specific flooding issues and areas of concern unique to each of the cities and villages in the County as further summarized in the table and maps in **Appendix G**.

Village of Baldwin

The Village has had no NFIP claims. Flooding on a small tributary of the Rush River which bisects the Village causes closure of Highway 63 every 4 to 5 years. The bridge is scheduled to be improved in 2008, which should help alleviate this flooding concern. However, there are currently limited crossings of the creek in the Village, and none which provides an adequate detour for Highway 63 which has over 11,000 vehicle trips in an average day along this segment.

The Village recently updated its FIRM map. Dredging on the east end of the primary stream channel has helped to mitigate some flood potential. A majority of the homes within the 100-year floodplain within the Village are located within a mobile home park. It is uncertain if all of these homes are appropriately anchored. A portion of one elementary school building may also be in the 100-year floodplain. Localized drainage and stormwater flooding concerns have also occurred along CTH "J" in this general area.

Stormwater improvements in recent years in the middle portion of the older Village center along the railroad tracks are believed to have remedied many of the past stormwater flooding concerns for that area. Further to the north along 8th Avenue, a newer home was built in an area which

disrupted stormwater drainage patterns. The result was ponding nearby up to 3-4 feet deep at times which could be a potential safety concern for children in the neighborhood.

Oct. 2002 Flooding in Deer Park

Village of Deer Park

Though the Village of Deer Park does not have a FEMA designated 100-year floodplain, it does have a significant flooding history. Groundwater levels fluctuate significantly, rising to flood levels every 10 to 12 years. As groundwater levels rise, springs and pond levels contribute to a general surface water flow to the south and southwest. A large pond on the east side of STH 46 rises about 15 more feet than its current level within one foot of the Highway level, though it has not resulted in the Highway's closure since the Highway was rebuilt. A home on the west side of the Highway was acquired and removed as part of past flood mitigation efforts. The ballpark was also raised 3 to 4 feet. Some infiltration of septic lines during times of flooding have also been occurring just southeast of the ballfield. During flooding, 22nd Street has often been closed to flooding, but culvert improvements were recently made. An older drainageway through this area may offer an opportunity to shift drainage toward the Willow River to the south, rather than through the Village. Should development occur on the northeast side of the Village stormwater runoff could potentially increase and exacerbate past problems if not carefully planned.

Village of Hammond

The Village of Hammond has very limited, unconnected areas of 100-year floodplain, which are largely stormwater storage areas during heavy rain and/or snowmelt events. Such natural storage areas are being incorporated into the Village's stormwater management plan currently under development. Overall, the Village has a good drainage system and no significant flooding issues were noted.

Village of North Hudson

Though the Village may have the largest number of potential high hazard floodplain properties of any municipality in the County, it has only had one NFIP claim at a home along the St. Croix River. Historically, flooding for the Village has been worst when floodwaters on the St. Croix River back-up due to flooding downstream on the Mississippi River.

During such times, floodwaters can back-up and overtop the Lake Mallalieu Dam resulting in the flooding along the north shore of the Lake. Such was the case in 2001, when flooding damaged a roadway and liftstation along the Lake. In total, about 55 structures along the Lake shore may be potentially located in the high hazard floodplain area.

Of more significant flooding concern to the Village are two areas along the St. Croix River. At Ferry Park, parkland and beach is being lost due to bank erosion and washouts. This can be very dangerous to children and beach-goers who may attempt to descend a bank which has become

unstable due to flooding. Similarly, to the south at the Browns Beach area, flooding and wave action has caused washouts and bank erosion. In this location, a house perched near the top of the bank is at risk of damage or sliding down the bank should current trends continue without mitigation steps.

About four times a year during heavy rain events, stormwater runs from the north along STH 35 towards the center portion of the Village resulting in the closure of the Highway. Damage is primarily limited to yards, though some limited basement flooding may occur for a few homes. This stretch of STH 35 carries about 12,000 vehicle trips in an average day. The Highway is scheduled to be improved in 2010, but the Village is uncertain if these improvements will fully address the related stormwater flooding concerns.

The dam shadows within the Village for the Little Falls Dam on the Willow River and the St. Croix Hydro Dam on the St. Croix River are both very similar to, or narrower than, the 100-year floodplains.

Village of Roberts

The Village of Roberts has no designated 100-year floodplain. No riverine or stormwater flooding concerns were noted for the Village.

Village of Somerset

The Village has had no NFIP claims or major riverine flooding impacts; most of the 100-year floodplain is within the Village park. A footbridge over the Apple River is frequently damaged and repaired due to flooding (e.g., 1993, 2001). Some scattered bank erosion along the River is occurring. The most significant stormwater flooding concerns are believed to be remedied, though new concerns can arise as development occurs. A drainage easement for a swale on the south side of the Village is desired for stormwater storage in anticipation of growth and increased stormwater flows.

Village of Spring Valley

Only two homes are located within the St. Croix County portion of the Village. The Village of Spring Valley is primarily covered under the *Pierce County All Hazards Mitigation Plan* which they have previously adopted. Most of that portion of the Village within St. Croix County is within the 100-year floodplain, the far majority of which is owned by the U.S. Army Corps of Engineers. The Eau Galle Dam managed by the U.S. Army Corps of Engineers has largely mitigated the very serious flooding problems of the Village of the past, and has helped to maintain water levels on Lake George.

Village of Star Prairie

Much of the 100-year floodplain along the Apple River within the Village is maintained as a Village Park; there have been no NFIP claims. There has been some stormwater ponding in the Bridge Street-Jewell Street intersection area which has damaged streets and yards, but no structural damage has been reported to date. The Village is working to remedy this problem area. The Village did receive NFIP sanction status in 1974, so residents are not eligible for Federal flood insurance. The Village should work with the State Floodplain Coordinator to ensure this deficiency is addressed, potentially limited to submittal of an updated floodplain ordinance and adoption of the new flood insurance rate maps.

Village of Wilson

No structures are believed to be located within the 100-year floodplain of the Village and there have been no NFIP claims. There have been no major flooding since the 1940's, when stormwater or flash flooding was a more significant concern. Local officials believe that as more farmland in the area has been converted to forests, stormwater runoff has been decreasing, and flooding within the Village has likewise decreased. Local officials also expressed some concern with the design of a new culvert under USH 12, but it has yet to be tested under a serious storm event to ensure that drainage is adequate.

Village of Woodville

The high hazard floodplain areas along Eau Galle Creek are primarily forested or in Village Park helping to explain the lack of NFIP claims in the Village. The River Street bridge over the Creek can disrupt flow and must be kept free of debris to prevent potential flooding. Local officials also noted two areas of significant bank erosion due to flooding and wave action. The Village has adopted a stormwater management plan and no significant stormwater flooding issues were noted.

City of Glenwood City

There are large areas of 100-year floodplain and dam shadow within the City, though there have been no NFIP claims and no significant flooding problems in recent history. Due to the small sizes of the streams and the hilly topography of the area, stormwater or flash flooding is likely a more significant concern, though no specific issues were noted at this time. The City has maintained the stream channel which helps moderate water levels and mitigates potential flooding. Portions of the City are within the hydraulic shadows of three high hazard dams, though these are dry dams with little or no normal water storage.

City of Hudson

Like the Village of North Hudson, riverine flooding along the St. Croix River is most serious when floodwaters on the Mississippi River cause the St. Croix River to back up. Local officials consider these floods, which occur 5-6 times every 20 years, to mostly be a nuisance. The nature of these riverine flooding events typically allows 12-15 days to prepare in advance of the flooding. Much of the City's 100-year floodplain is in City Park, and a combination of existing seawalls and temporary sandbagging are used to mitigate potential flooding. Though about 43 structures, including 6 marina docks, may be located within the high hazard floodplain areas, there have only been 3 NFIP claims in the City.

April 2001 Flooding in Hudson

Riverine flooding has impacted streets and 10 to 13 garages in an area of condominium units just south of Interstate 94 in the past, though the homes themselves are believed to be elevated above 100-year floodplain levels. Two of the City's NFIP claims have come from this general area. Farther north along the River, Buckeye Garage floods with 5 to 6 feet of water every 3 years, with nearby structures protected with sandbags. Portions of the City's wastewater treatment plant may be located within the 100-year floodplain, but no serious flooding history for the facility is noted.

Perhaps more significantly, development in eastern portions of the City is increasing stormwater flows towards the St. Croix River to the west. The stormwater often travels through old drainageways, gaining in speed and intensity as it travels down the hill towards the river. Stormwater systems in older neighborhoods were not necessarily designed to handle such flows and are overwhelmed approximately two times per year. Basement and garage flooding in the Locust & 5th Streets neighborhood and the Nye & Aldrich Street neighborhood can be significant. On the south side of Intestate, significant amounts of stormwater runoff from large-span buildings and many parking lots flows towards the river and is captured in a large stormwater basin. Debris can block the normal flow of stormwater into and out of this basin, resulting in localized flooding concerns. The high rate of growth in the Hudson area will continue to require a high level of attention to stormwater management.

The dam shadows within the City for the Little Falls Dam on the Willow River and the St. Croix Hydro Dam on the St. Croix River are both very similar to or do not exceed the boundaries of the 100-year floodplains.

City of New Richmond

A significant number of structures around the Mill Pond may be located within the high hazard floodplain areas of the City. A portion of the historic district and a nearby historic home on the south side of the pond may also be within the 100-year floodplain. Four NFIP claims on four properties immediately north of the Mill Pond have been made in the past, though the City has not experienced major flooding since 1967. A seasonal home further down stream has had some flooding problems in the past. The new dam has greatly helped to mitigate potential flooding overall by allowing the drawdown of water levels.

In recent years, the most significant flooding concern has been occurring near the Armory along CTH "CC" which has impacted two homes in the past, as discussed previously in the summary of unincorporated areas prone to flooding. The City's proposed development of the recreational park to the northeast has some potential to help alleviate the flooding near the Armory by reducing stormwater runoff.

Run-off due to development near Paperjack Creek in the 140th Street area is reported to be causing some flooding concerns for houses in this area, but this is largely within the adjacent Town. Also nearby in the Town, ice damming and flooding has been a problem in the past along the Willow River just before it crosses CTH "K", resulting in a past NFIP claim.

City of River Falls

The City of River Falls is primarily covered under the *Pierce County All Hazards Mitigation Plan* which it previously adopted. The Kinnickinnic River does flow through the St. Croix County portion of the City and there has been significant growth in recent years on the City's north side. Though there has been some potential residential and commercial development in the high hazard floodplain areas of the St. Croix County portion of the City, there has been no NFIP claims or notable flood event history.

St. Croix County Dams – Vulnerability to Dam Failure

St. Croix County has 59 dams and levees according to the Wisconsin Department of Natural Resources (WisDNR) database as summarized for St. Croix County in **Appendix H**. Most of the dams (43 of the 59) are small and only 16 dams in the County have more than 10-acre feet of normal storage, and the far majority having normal storage of less than 5-acre feet. In most cases, if these smaller dams failed, the runoff downstream would hardly be noticed.

As discussed previously, the County has had no significant flooding due to dam failure since at least the mid-1960s, though washouts on older dams were not uncommon prior to that time. Based on interviews with Wisconsin DNR and local officials, all significant and high hazard dams in St. Croix County are in good structural conditional, with many undergoing structural improvements within the last 20 years. Flooding due to failure of these dams should not occur if these dams continue to be well maintained.

The high and significant hazard dams of St. Croix County are shown in **Figure 17**. Hazard ratings are assigned by the Wisconsin Department of Natural Resources based on the potential for loss of life or property damage should the dam fail. The dam hazard ratings are defined by FEMA as follows:

Low Hazard Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

Significant Hazard Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

High Hazard Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

There are nine high hazard dams, six of which are owned by St. Croix County in the Glenwood Hills area and one each owned by the City of New Richmond (Mill Pond Dam), Xcel Energy (Riverdale Dam), and Wisconsin Department of Natural Resources (Little Falls Dam). One of the County-owned high hazard dams may be downgraded to low hazard in the near future if documentation regarding zoning downstream is provided to WisDNR. The County also has two

significant hazard dams—one in the Glenwood Hills area owned by the County and the Apple River Falls Dam owned by Xcel Energy. All of these dams are highly regulated, inspected regularly, and have emergency action plans on file with the St. Croix County Emergency Management office.

This analysis is most concerned with those dams and levees which pose a high or significant hazard vulnerability for St. Croix County. The dam or hydraulic shadows discussed in this section are very approximate and are primarily used as a guideline for prioritizing evacuation zones. In the rare event of a dam failure, the actual flooded areas may be larger or smaller than the dam shadow maps show and can vary significantly depending on weather, surface water, and soil conditions at the time of the event. A brief assessment of each of these high or significant hazard dam structures appears below.

Glen Hills Dams (St. Croix County) – 3 Low, 1 Significant, 5 High Hazard, plus 1 H/L

The Glen Hills Dams consists of 10 structures built in the 1960s located in the eastern side of St. Croix County, with most of the dams controlling waters running into Tiffany Creek which flows through the Glenwood City and the Villages of Downing and Boyceville in Dunn County. Many local officials in the area identify the Glen Hills Dams as being a primary contributor to the decrease in flooding problems along Tiffany Creek in recent years.

The five high hazard dams all have automated alarm systems, emergency action plans, and evacuation plans. The emergency action plans are updated annually to include the names and phone numbers of St. Croix County residents which may be located in the dam shadow should evacuation be prudent. The alarms notify County dispatch which then contacts a Sheriff deputy or Glenwood City police to visually check the dam; Dunn County is alerted as well through dispatch. The dams are inspected monthly during the high water season of April through October, including alarm tests.

St. Croix County keeps the Glen Hills dams well maintained and no structural issues for these dams were identified during the planning process, though water levels have been at or near capacity on occasion.

A summary of notable characteristics for each of the high and significant hazard dams and their inundation areas follows. Four of these dams (#4,#5,#6,#7) are dry dams and do not typically store water, but are available for flood prevention should a storm event occur.

GH #4 Glen Hills #4 is a High Hazard Dry Dam on a tributary of Tiffany Creek. The inundation area, should a failure occur, would follow closely, but be slightly larger than the high hazard floodplain area, with a significant number of structures within the City of Glenwood City vulnerable. Flood waters would reach and inundate the mobile home park on the west side of the City in about 20 minutes with an incremental rise of about 4 feet. Flood waters would reach Oak Street downtown in about 50 minutes with a rise of 4.2 feet. Flooding equivalent to a 100-year flood may also be experienced in Downing in Dunn County.

GH #5 Glen Hills #5 is a High Hazard Dry Dam on a tributary of Tiffany Creek. The inundation areas for Dam #5 are very similar to those of #4 and, again, follow

closely, but are slightly larger than the high hazard floodplain area. Flooding would be slightly less severe, with the incremental rise at Oak Street of 2.9 feet with a travel time of 55 minutes. Flooding equivalent to a 100-year flood may also be experienced in Downing in Dunn County.

GH #6 Glen Hills #6 is a High Hazard Dry Dam on a tributary of Tiffany Creek. Dam #6 is on the east side of the City of Glenwood City and would not inundate the larger areas of residential and downtown which would be vulnerable if failure at Dams #4 or #5 should occur. The inundation areas for Dam #6 closely follow, but are slightly larger than the high hazard floodplain area. Some local industry may be impacted. A portion of the High School may also be inundated by a failure with a travel time of flood water of 35 to 40 minutes from the dam to the school. Until floodwaters reach the large floodplain to the south, the incremental rise will typically be between 2.5 to 3.5 feet, rising higher in areas where floodwater are constricted (e.g., STH 170 bridge). Flooding equivalent to a 100-year flood may also be experienced in Downing in Dunn County.

GH #7 Glen Hills #7 is a High Hazard Dry Dam on non-navigable Sandy Creek. Failure of Dam #7 would result in an inundation area much larger than the estimated 100-year floodplain which is not designated on FEMA FIRM maps. The potential number of structures directly impacted by a failure is very small.

GH #8 Glen Hills #8 is a Significant Hazard Dam with a very small reservoir of 43 acre feet under normal conditions on non-navigable Sandy Creek. This area of Sandy Creek does not have a corresponding FIRM map or officially designated 100-year floodplain. In 2003, this dam experienced some erosion, but the facility functioned properly and repairs were made. The potential number of structures directly impacted by a failure is very small.

GH #10 Glen Hills #10 is a High Hazard Dam with 1,471 acre feet reservoir under normal conditions on Beaver Creek to the south of Glenwood City. Five residences are within the hydraulic shadow within St. Croix County. More structures within Dunn County are potentially located in the inundation area should a dam failure occur, including a significant portion of the Village of Downing. Flood waters due to a failure would reach Downing in 1.7 hours with an incremental rise of 7.5 feet, exceeding a 100-year flood event and likely resulting in serious damage within the Village.

Glen Hills Dam #10

Glen Hills #2 Dam, though currently a low hazard dam, has experienced significant residential "creep" in the past. The County was successful in obtaining financial support to re-locate a home to higher ground out of the dam shadow.

Glen Hills #3 Dam officially has a high hazard rating at this time, but does not have a related emergency action plan and inundation map. However, with the provision of adequate documentation to the Wisconsin Department of Natural Resources regarding zoning in the dam's hydraulic shadow, the hazard rating will likely be reduced to low.

New Richmond Mills Dam (City of New Richmond) – High Hazard

The New Richmond Mills Dam located within the City of New Richmond on the Willow River was reconstructed in 1996, allowing greater control over water levels to help mitigate potential flooding. Two residential structures, one being a seasonal home, lie within the dam shadow according to the 1998 inundation map.

Little Falls Dam (Wisconsin Department of Natural Resources) – High Hazard

Little Falls Dam is located in the Willow River State Park, approximately two miles up the Willow River from the City of Hudson and Village of North Hudson. Approximately 23 residences are within the dam shadow inundation area for Little Falls Dam as potential priorities for evacuation; the largest concentration of these are 14 homes located in the Trout Brook Road area. Radio telemetry or other early warning link to the Lower Power Dam at Lake Mallalieu has been under discussion to automate opening of flood gates if needed.

Riverdale Dam (Xcel Energy) – High Hazard

The Riverdale Dam is located approximately 3 miles upstream of the Village of Somerset on the Willow River. The inundation area for the first 2 to 3 miles downstream of the dam should a failure occur is significantly larger than the high hazard floodplain area. Between five and eight structures may be located within this portion of the inundation area, with about four structures located within the first mile. Further down river, the inundation area significant narrows and closely follows the river channel and 100-year floodplain to the Apple River Fall Dam. Some seasonal cabins on the north side of the Village of Somerset may be within the inundation area. Under flood conditions, floodwaters would take one hour and five minutes for the start flooding on the southeast side of the Village of Somerset should a failure occur at the Riverdale Dam located 3.18 miles upstream. Peak flooding would occur in 1 hour 48 minutes at the Village. Floodwaters would reach the Apple River Falls Dam in 1.5 hours and peak about an hour later under flood conditions.

Apple River Falls Dam (Xcel Energy) – Significant Hazard

The Apple River Falls Dam is located approximately 6.59 miles downstream of the Riverdale Dam and 2.32 miles upstream of the backwaters of the St. Croix River. The inundation area for a failure of the Apple River Falls Dam could be slightly larger than the 100-year floodplain for the first mile downstream, but would closely follow the 100-year floodplain boundary thereafter to the St. Croix River. The dam power plant itself is within the inundation area, as well as 5 to 6 structures closer to the mouth of the River where it joins with the St. Croix River. Should a failure occur, less time would be available for evacuation compared to the Riverdale Dam. Flood conditions would begin in 10-12 minutes at the mouth of the Apple River and peak

flooding would occur within 30 minutes, likely allowing less 10 minutes or less to evacuate the 5 to 6 structures just upstream of the confluence before flooding begins.

St. Croix Hydroelectric Dam (Xcel Energy) – High Hazard – Not in the County

The largest dam potentially impacting St. Croix County should a failure occur is not actually located in the County. St. Croix Hydroelectric Dam at St. Croix Falls is owned by Xcel Energy, and is the only existing dam on the St. Croix River. As a power-producing dam, it is highly regulated under FERC licensing standards.

In the very unlikely event of a failure at the St. Croix Dam, floodwater would take over four hours to reach St. Croix County allowing significant, though limited, time to evacuate and prepare. In comparing the dam hydraulic shadow analysis to the 100-year floodplain maps for St. Croix County, the dam's hydraulic shadow is very comparable to that of the 100-year floodplain of the County, being equal or less than the high hazard floodplain boundary in most instances.

Floodwaters from a dam failure based on the dam inundation map would reach the northern part of St. Croix County in 4.4 hours after the failure with an incremental rise in floodwaters of 4.6 feet. It would be nearly another 4 hours (8.3 hours total) before floodwater would reach Houlton with an incremental rise of 4.0 feet. This upper stretch of floodplain is relatively sparsely populated in large part due to significant amounts of Federal, State, and Boy Scout camp lands, in additional to special development regulations as a National Scenic Riverway. As floodwaters travel south, a large area on the Minnesota side of the River in the Bayport area becomes a wide floodplain compared to the more narrow floodplain of the Wisconsin side due to bluffs along the River. The result is a significant drop to only 1.9 feet in the incremental rise of floodwaters by the time they reach Lake Mallalieu 8.7 hours after the failure. And south of the Interstate 94 bridge, the inundation areas for dam failure are expected to be less than a 100-year flood event and are no longer mapped as part of the dam emergency action plan.

vi. Pandemic Flu

Risk Assessment – Pandemic Flu

The Hazard

A **pandemic** is a global disease outbreak. An **influenza pandemic** occurs when a new influenza A virus emerges for which there is little or no immunity in the human population, begins to cause serious illness, and then spreads easily person-to-person worldwide.

Avian (or bird) flu is caused by influenza viruses that occur naturally among wild birds. The high-pathogenic H5N1 variant (Asian Bird Flu) is deadly to domestic fowl and can be transmitted from birds to humans, though the H5N1 virus usually does not infect people. There is no human immunity and no commercial vaccine is available. However, clinical trials to develop a vaccine for H5N1 are underway and there has been substantial Federal funding for research on a variety of antiviral drugs and immune system boosters.

There is a low-pathogenic H5N1 variant (North American Bird Flu) which commonly occurs in wild birds. In most cases, it causes minor sickness or no noticeable signs of disease and is rarely fatal in birds. Unless otherwise specified, the avian flu or H5N1 referred to in this report refers to the more highly-pathogenic variant or Asian H5N1.

How often does Pandemic Flu occur?

Historically, the 20th century saw 3 pandemics of influenza:

- 1918 influenza pandemic caused at least 675,000 U.S. deaths and up to 50 million deaths worldwide
- 1957 influenza pandemic caused at least 70,000 U.S. deaths and 1-2 million deaths worldwide
- 1968 influenza pandemic caused about 34,000 U.S. deaths and 700,000 deaths worldwide

What is the Current Distribution of Bird Flu (H5N1)?

To date, there has been no human-to-human transmission of bird flu. It is not considered a pandemic. Since 2003, there have been 267 human cases of bird flu reported worldwide of which 161 (60%) resulted in death. However, this death rate may be misleading, since it is uncertain how many individuals contracted the infection, were not diagnosed, then later recovered.

In 2006, the following cases of H5N1 were reported to the World Health Organization:

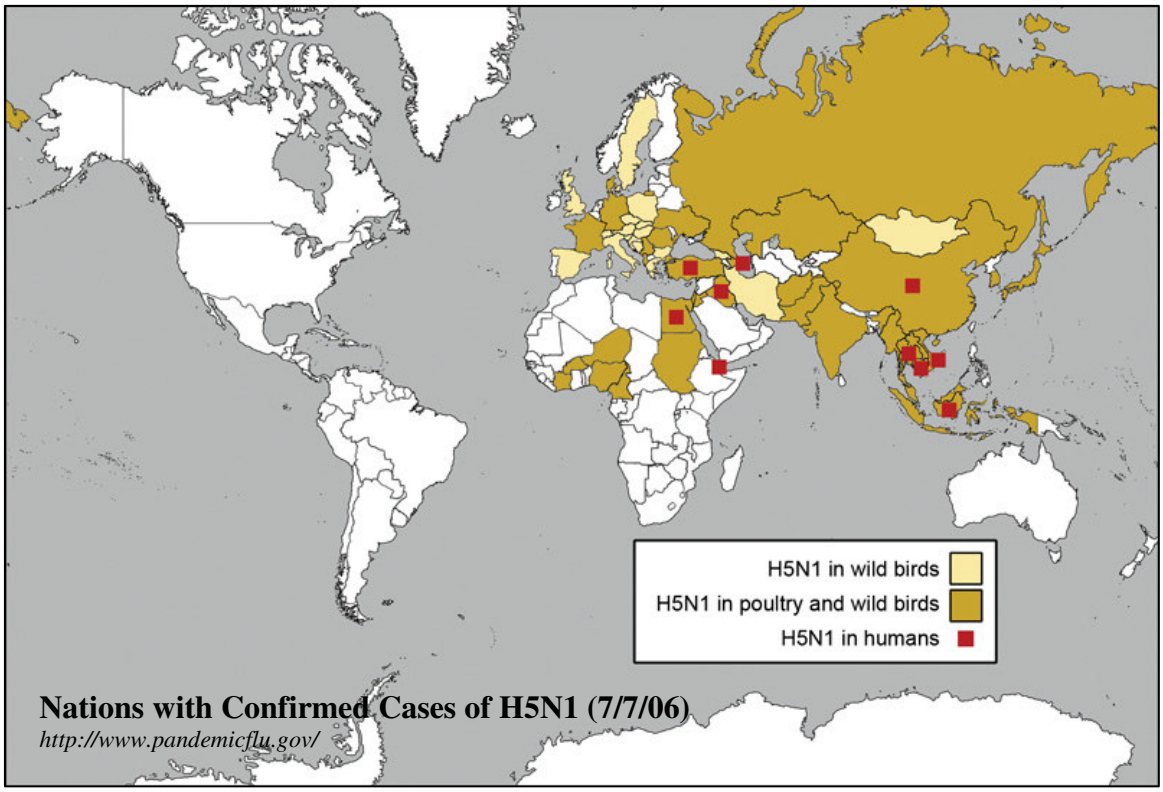
Country	cases	deaths
Azerbaijan	8	5
Cambodia	2	2
China	13	8
Djibouti	1	0
Egypt	18	10
Indonesia	56	46
Iraq	3	2
Thailand	3	3
Turkey	12	4
Total	116	80

The H5N1 virus has also affected humans in Viet Nam in the past, but no other human cases in countries other than those reported above have been confirmed. The CDC has not recommended any travel restrictions to countries affected by H5N1 at this time.

The H5N1 virus has been found in wild birds or poultry throughout most of Asia and parts of Europe and Africa, but no migratory birds in North or South America to date have tested positive for the severe strain of avian flu (Asian H5N1).

In 1983-1984, approximately 17 million chickens, turkeys, and guinea fowl were euthanized in Virginia and Pennsylvania to contain and eradicate Asian H5N1. More recently in 2004, an Asian H5N1 outbreak among chickens in Texas was quickly eradicated. Less severe strains of

avian influenza are routinely found and eliminated in U.S. poultry flocks, and a vaccine for poultry has been shown to be effective against the current S.E. Asian H5N1 virus. These successes demonstrate the ability of the USDA to work with states and local governments to contain such outbreaks.



Nations with Confirmed Cases of H5N1 (7/7/06)
http://www.pandemicflu.gov/

Risk to St. Croix County

The steering committee for this planning project rated the risk of future occurrence of pandemic flu in St. Croix County as slightly less than moderate (2.89 out of 5.0).

Currently, H5N1 is the most significant potential pandemic, given the death rate if contracted. However, H5N1 is not the same as the Spanish Flu pandemic of 1918. While the H5N1 virus has the potential to mutate or change into a virus that can be transmitted from human to human, it has not done so to date.

The probability of mutation of H5N1 is unknown. As more people are infected, the opportunities for the strain to mutate into a strain which can be spread person-to-person are increased. While only 267 world-wide cases have been confirmed since 2003, the virus has lingered since around 1997. This demonstrates the importance of the research for a H5N1 vaccine in order to halt the spread of the current H5N1 virus as a means of decreasing the probability of mutation.

If mutation should occur, it is not certain if existing vaccines and medications will offer effective treatment, or how difficult it will be to produce a new vaccine. Flu viruses can also further mutate and become resistant to certain medications over time. It is also not certain how fast the mutated virus would spread.

Pandemic flu risks will likely always be slightly higher for St. Croix County compared to many of the more rural areas of Wisconsin, given the County's growing population and proximity to the Minneapolis-St. Paul urban center. In 2000, over 96% of the County's working residents commuted to their place of employment. About 81% commute outside their community, and 51% commute to a workplace outside of St. Croix County. And 39% (over 13,200 St. Croix County residents) commute to the Minnesota counties of Washington, Ramsey, and Hennepin.

Vulnerability Assessment – Pandemic Flu

As discussed earlier, of the 267 confirmed human H5N1 cases, 161 (or 60%) resulted in death. This death rate is likely inflated since there have probably been unreported cases where individuals have contracted the virus but recovered. Regardless, the death rate for this virus, if contracted, is quite high. It is uncertain whether a mutated version of virus would be as deadly.

The current annual flu shots do not offer protection against H5N1, as they do not target this strain. If the virus should become a human virus, it may take several months to develop a vaccine specific to the strain. However, it is possible that existing anti-viral drugs (e.g., Tamiflu) may be effective against a pandemic strain, though a vaccine would likely initially be in short supply.

If H5N1 changes into a human virus or other such pandemic occurs, it would likely have vast impacts on our society and economy. An initial panic among the public could occur, requiring additional security measures. A policy of social distancing would be recommended until the virus is controlled to limit the exposure and transfer of the virus. This policy includes closing schools and certain places of employment, as well as canceling large public or community events. Travel could be limited. Those potentially exposed to the virus, but not yet sick, could be quarantined.

Researchers at the Center for Disease Control and Prevention in Atlanta, GA, evaluated the potential impacts of a pandemic flu event which is summarized below:

> "We estimated the possible effects of the next influenza pandemic in the United States and analyzed the economic impact of vaccine-based interventions. Using death rates, hospitalization data, and outpatient visits, we estimated 89,000 to 207,000 deaths; 314,000 to 734,000 hospitalizations; 18 to 42 million outpatient visits; and 20 to 47 million additional illnesses. Patients at high risk (15% of the population) would account for approximately 84% of all deaths. The estimated economic impact would be US $71.3 to $166.5 billion, excluding disruptions to commerce and society. At $21 per vaccinee, we project a net savings to society if persons in all age groups are vaccinated. At $62 per vaccinee and at gross attack rates of 25%, we project net losses if persons not at high risk for complications are vaccinated. Vaccinating 60% of the population would generate the highest economic returns but may not be possible within the time required for vaccine effectiveness, especially if two doses of vaccine are required."[15]

[15] Martin I. Meltzer, Nancy J. Cox, and Keiji Fukuda. "The Economic Impact of Pandemic Influenza in the United States: Priorities for Intervention". Center for Disease Control and Prevention. Atlanta, GA. *http://www.cdc.gov/ncidod/EID/vol5no5/meltzer.htm.*

The above numbers should be kept in perspective given the total U.S. population of over 288 million in 2000. These estimates have a death rate of between 0.03% and 0.09% of the U.S. population. Hospitalizations would be equivalent to 0.10% to 0.25% of the population, if no individual is hospitalized more than once. For discussion purposes only, this could be further extrapolated based on St. Croix County's population. Of the 76,227 County residents as of 2000, this would be equivalent to 23 to 55 deaths, 83 to 194 hospitalizations, and between 4,757 and 11,101 outpatient visits.

Current Mitigation and Planning Measures

International

Ever since SARS, there has been a higher level of awareness, cooperation, monitoring, and reporting among public health organizations around the world regarding the prospect of another large-scale disease or viral outbreak. Cooperation between national governments and the World Health Organization has improved tremendously, and public health ministries are on the alert for the first signs of an influenza pandemic.

Federal

A wealth of information on avian and pandemic flu can be found at http://www.pandemicflu.gov/ which is managed by the U.S. Department of Health and Human Services. The Federal government has implemented numerous policies and initiatives regarding avian and pandemic flu, such as:

- In 2005, the *National Strategy for Pandemic Influenza* was issued which guides our Nation's preparedness and response to an influenza pandemic.
- In 2006, the *Implementation Plan for the National Strategy* was issued which identifies more specific actions, sets expectations, and guides Federal agencies in the development of their own plans.
- Many Federal departments and agencies have established their own websites with information on pandemic flu plans, policies, resources, and updates on related activities.
- The USDA manages the Highly Pathogenic Avian Influenza Early Detection Data System (HEDDS) which monitors and provides data on the testing of migratory birds for avian flu under the Interagency Screening Plan.
- The USDA maintains trade restrictions on the importation of poultry and poultry products from countries affected by Asian H5N1.

As a result of the major Mississippi Valley flooding of the 1990s, World Trade Center bombings of 2001, the 2005 Katrina Hurricane, SARS, and other natural disasters in recent decades, the Federal government has also been increasing emphasis on emergency planning and related funding in general. Efforts such as the National Incident Management System (NIMS) will be valuable, regardless of the disaster.

State of Wisconsin

The State of Wisconsin has received over $1.8 million in phase-one funding from the U.S. Department of Health and Human Services (DHHS) for pandemic planning activities. An

additional $4.1 million in phase two funding for Wisconsin is anticipated to address any preparedness gaps identified during the phase one planning efforts.

Information on the pandemic flu as it relates to Wisconsin can be found at the Wisconsin's Pandemic Flu Resource website (http://pandemic.wisconsin.gov/), including the following initiatives which have been developed or are being implemented:

- In March 2006, the State entered into a planning resolution with the U.S. DHHS which detailed shared and independent responsibilities.
- A Statewide Pandemic Readiness Summit was held in March 2006.
- *Wisconsin Pandemic Influenza Preparedness Plan*
- *Response to an Animal Influenza Emergency* plan
- *Wisconsin Emergency Human Services Response Plan*
- *Wisconsin Mass Clinic Plan*

Local and regional planning within the State of Wisconsin has been primarily through thirteen consortia representing different regions and the Tribal governments.

Local and Regional Activities

The Public Health Office within the St. Croix Department of Health and Human Services has been the primary coordinating entity on pandemic flu within the County. However, local planning and preparedness activities have been occurring under the coordinating efforts of the Western Regional Partnership for Public Health Preparedness (WRPPHP), the State-recognized consortium for this region.

WRPPHP covers eleven counties in west-central Wisconsin, in addition to the St. Croix Chippewa Tribe. The Consortium of public health officials from these counties works closely with the State to coordinate training, monitoring, and preparedness planning in the region. The Consortium's activities regarding pandemic flu include:

- establishing and maintaining up-to-date regional objectives and priorities related to health preparedness through the Public Health Emergency Plan
- sponsoring training on the Incident Command System (ICS), NIMS, etc.
- monitoring and surveillance for potential disease or viral outbreaks, such as tracking school truancy and sickness patterns and promoting the sharing of information between hospitals (increasing redundancy)
- applying the BT Model from Cornell University to help determine clinic immunization needs within the member counties
- implementing pilot projects, such as the Polk County effort to identify individuals with special needs via the Internet
- coordinating with the Cities Readiness Consortium, which is performing similar activities for the Minneapolis/St. Paul area within Minnesota

- networking with other groups and service providers to maximize resources and cooperation, including faith-base organizations and the Red Cross

WRPPHP has a full-time staff consisting of a Program Director, Epidemiologist, and Training/Education Coordinator. Additional information regarding WRPPHP can be found at their website: http://www.co.polk.wi.us/wrpphp/default.htm.

With the guidance and support provided by WRPPHP, St. Croix County's Public Health Office has developed a Public Health Emergency Plan specific to the County. Much of this preparedness at the local level is not specific to pandemic flu, but is an all hazards approach. All Public Health Office staff have been trained on NIMS and is currently working through the ICS training program, in addition to on-going discussions and brief training sessions as part of regular staff meetings. This repetition in training helps to increase confidence and familiarity in emergency policies and procedures if an event should occur. During the Summer of 2007, updates to both the Mass Clinic Plan and Pandemic Flu Plan portions of the County Public Health Emergency Plan were completed. Each portion has been tested locally through drills.

In addition to updating the objectives of the Public Health Emergency Plan, the Public Health Office is currently working with WRPPHP on policies and training related to the interim pharmaceutical stockpile. Memoranda of Understanding and related plans are in place with St. Croix Central (Hammond) and New Richmond schools as mass clinic dispersing sites for pharmaceuticals.

vii. Hazardous Materials Incidents

During the planning process, the Steering Committee identified hazardous materials spills as a 6th highest hazard risk (frequency) and tied for the 4th highest hazard vulnerability (potential impact) in St. Croix County. Though hazard materials spills are not commonly included in hazard mitigation plans, the County felt the associated risks and vulnerabilities necessitated this overview as part of the assessment. Due to the obvious relationship between the two, groundwater contamination, focusing on point-source pollution (e.g., spills, releases), will also be included within this overview.

Risk Assessment—Hazardous Materials

The Hazard

Hazardous materials and substances can present special risks to humans and the environment at the time of disaster, as well as pose substantial difficulties and necessitate special precautions for post-disaster clean-up.

There are many definitions and descriptive names being used for the term "hazardous material," each of which depends on the nature of the problem being addressed. Unfortunately, there is no one list or definition that covers everything. The United States agencies involved, as well as state and local governments, have different purposes for regulating hazardous materials that, under certain circumstances, pose a risk to the public or the environment.

The following are some of these federal definitions:[16]

Hazardous Materials

The United States Department of Transportation (DOT) uses the term "hazardous materials" which covers eight hazard classes, some of which have subcategories called classifications, and a ninth class covering other regulated materials (ORM). The DOT includes in its regulations hazardous substances and hazardous wastes, both of which are regulated by the Environmental Protection Agency (EPA), if their inherent properties would not otherwise be covered.

Hazardous Substances

The EPA uses the term "hazardous substance" for the chemicals which, if released into the environment above a certain amount, must be reported and, depending on the threat to the environment, federal involvement in handling the incident can be authorized. A list of the hazardous substances is published in 40 CFR Part 302, Table 302.4.

Extremely Hazardous Substances

The EPA uses the term "extremely hazardous substance" for the chemicals which must be reported to the appropriate authorities if released above the threshold reporting quantity. Each substance has a threshold reporting quantity. The list of extremely hazardous substances is identified in Title III of Superfund Amendments and Reauthorization Act (SARA) of 1986 (40 CFR Part 355).

Toxic Chemicals

The EPA uses the term "toxic chemical" for chemicals whose total emissions or releases must be reported annually by owners and operators of certain facilities that manufacture, process, or otherwise use a listed toxic chemical. The list of toxic chemicals is identified in Title III of SARA.

[16] Ingham County Emergency Planning Committee, Hazardous Materials Page, http://www.orcbs.msu.edu/AWARE/pamphlets/hazwaste/hazmatdef.html, as of Feb 2004.

Hazardous Wastes

The EPA uses the term "hazardous wastes" for chemicals that are regulated under the Resource, Conservation and Recovery Act (40 CFR Part 261.33). Hazardous wastes in transportation are regulated by the DOT (49 CFR Parts 170 - 179).

Hazardous Chemicals

The United States Occupational Safety and Health Administration (OSHA) uses the term "hazardous chemical" to denote any chemical which is a physical hazard or a health hazard. Hazardous chemicals cover a broader group of chemicals than the other chemical lists. There is no list of hazardous chemicals, but they are any substance for which OSHA requires a facility to maintain a Material Safety Data Sheet.

Hazardous Substances

OSHA uses the term "hazardous substance" in 29 CFR Part 1910.120, which resulted from Title I of SARA and covers emergency response. OSHA uses the term differently than EPA. Hazardous substances, as used by OSHA, cover every chemical regulated by both DOT and EPA.

Originally, the United States Congress compiled a list of specific toxic chemicals (approximately 300) and chemical categories (approximately 20) based on two existing lists in use by the States of New Jersey and Maryland. The two states created their respective lists of chemicals using information such as toxicity, the amount produced or used in their state, or their professional judgment as to the potential hazards of the chemicals in the environment.

If there is sufficient evidence, chemicals may be added to or deleted from the list by the administrator of the EPA. The criteria that the EPA uses to define and evaluate toxic chemicals for addition to the list are specified in Title III of SARA and are listed below:

1. The chemical is expected to cause significant adverse acute human health effects at concentration levels which are likely to exist beyond the facility site boundaries as a result of a release. Acute (short-term) effects occur rapidly as a result of short-term exposure, usually to high concentrations of a chemical.
2. In humans, the chemicals are expected to cause cancer, birth defects, nervous system effects, gene mutations which can be passed on to the next generation, or other chronic (long-term) health effects associated with repeated exposure to a chemical over a long period of time.
3. The chemical is expected to cause significant and seriously adverse effects on the environment due to its toxicity, and/or its persistence (tendency to remain in an unchanged form, rather than breaking down into smaller chemical parts), and/or its tendency to bioaccumulate (to become increasingly concentrated in plant and animal tissue).

A solid waste may be a "listed hazardous waste" if it appears in one or more U.S. Environmental Protection Agency tables that list hazardous wastes. Other solid wastes are "characteristic hazardous wastes" because they exhibit any of the four hazardous waste characteristics: corrosiveness, reactivity, toxicity, or ability to ignite. If the waste is hazardous, then it must be

managed in compliance with the applicable sections of NR 600-685, Wisconsin Administrative Code (DNR Pub SW-232).

Within this Plan, we apply the term "hazardous materials" broadly to include....

...any substance or combination of substances (including wastes of a solid, liquid, gaseous, or semi-solid form) which, because of it quantity, concentration, physical chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality, or increase in serious irreversible or incapacitating illness, or pose a potential hazard to human health or the environment.

Further, this plan only focuses on point sources of contaminants due to a hazardous materials incident, such as a hazardous materials spill or a release from a leaking tank. The only exception to this is a very limited discussion on atrazine, since there are four designated atrazine prohibition areas in the County.

This definition encompasses the hazardous substances and wastes definitions provided previously, including those chemicals required to be reported under Title III of SARA, otherwise known as the Emergency Planning and Community Right-to-know Act (EPCRA). Companies across a wide range of industries (including chemical, mining, paper, oil and gas industries) that produce more than 25,000 pounds or handle more than 10,000 pounds of a listed toxic chemical must report it to the Toxics Release Inventory.

One of the potential environmental impacts of a hazardous materials release or spill is groundwater contamination. Groundwater collects or flows beneath the Earth's surface, filling the porous spaces in soil, sediment, and rocks, and is the source of water for aquifers, springs, and wells. The degradation or pollution of groundwater quality due to some substance or toxin introduced or spilled onto the soil and making its way to the groundwater can pose health risk for those relying on local groundwater as a potable water supply.

National & Regional Trends

Under the Emergency Planning and Community Right-to-Know Act (EPCRA), there are more than 7,000 facilities in Wisconsin that plan and report use/storage of certain potentially hazardous chemicals. The EPCRA Program requires communities to prepare for hazardous chemical releases through emergency planning and by maintaining hazardous chemical information that is submitted to them by the facilities covered under the law. This does not include practices which are exempt from such reporting, such as routine agricultural operations and retail gas stations.

According to the Wisconsin Department of Natural Resources, there are 11,496 businesses, schools, and government institutions in Wisconsin that generate varying quantities of hazardous wastes each year. Overall, the number of hazardous waste generators and the quantity of hazardous waste that they generate are declining each year as everyone learns how much it costs to generate wastes and manage hazardous wastes according to the strict requirements that apply. The number of largest generators has been decreasing significantly in recent years while the number of very small generators has been increasing slowly. While much of the solvent-type

hazardous wastes that are generated in Wisconsin are recycled here, many other hazardous wastes are handled out of state.

Wisconsin has 157 active Superfund sites or sites which have been under consideration for Superfund status. A Superfund site is any land in the United States that has been contaminated by hazardous waste and identified by the Environmental Protection Agency (EPA) as a candidate for cleanup because it poses a risk to human health and/or the environment. There are tens of thousands of abandoned hazardous waste sites in our nation, and accidental releases occur daily. At the core of the Superfund program is a system of identification and prioritization that allows the most dangerous sites and releases to be addressed within the confines of limited Federal funding and human resources. The first step in the Superfund process is to identify abandoned or uncontrolled hazardous waste sites. All sites where releases or potential releases have been reported are listed in the Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). Those Superfund sites determined to pose the greatest risks to humans or the environment are identified on the Superfund National Priority List (NPL). Many of these NPL locations are former mining sites, hazardous/solid water dumps, chemical/fuel companies, and industrial areas which produced military ammunition. Wisconsin has 37 sites on the National Priority List.

Wisconsin also is home to approximately 17 licensed hazardous waste management facilities, which have also been decreasing in number.[17] Many of these facilities are privately operated, serving the needs of that particular facility's hazardous wastes. The commercial hazardous waste facilities in Wisconsin primarily focus on recycling of hazardous waste solvents and mercury, fuel blending of hazardous wastes for energy recovery, storage of hazardous wastes prior to the treatment at licensed hazardous waste facilities in other states, and treatment of hazardous wastes to facilitate disposal. There are no operating hazardous waste disposal facilities (i.e., landfills) in Wisconsin, but there are three incinerators (two private and one commercial) and two non-commercial open burning/open detonation facilities for reactive (explosive) hazardous wastes.

The use of chemicals and hazardous materials is part of daily life. As could be expected, the largest site-specific toxic releases in Wisconsin are at heavy industrial facilities, power plants, military installations, and paper/pulp mills. However, non-point pollution of surface and ground waters from agricultural run-off, contaminants in stormwater, and improper disposal of household chemicals (e.g., bleach, used motor oil, paints) can also cause environmental harm.

And sometimes hazardous materials spills can be the result of natural hazard events. For instance, on June 7, 1980, a Chicago & Northwestern train derailed in Chippewa County due to a flash flood which washed out the tracks. Three cars of #6 fuel oil were torn open, and 86,000 gallons spilled. Containment dikes were built and most of the oil was recovered.

More significantly, the Wisconsin Central line which runs through Hudson, Roberts, Hammond, Baldwin, Woodville, and Wilson is the same line on which the 1996 Weyauwega derailment occurred in eastern Wisconsin. In March 1996, a train with 7 cars of liquid petroleum gas, 7 cars of propane, and 2 cars of sodium hydroxide derailed; and a fire ensued to the cars themselves as well as an adjacent feed mill. Approximately 2,300 people were evacuated due to the fire and

[17] Ibid.

leaking chemicals for 16 days, including all City of Weyauwega residents. Additional issues arose when many residents illegally began to re-enter the evacuation area to retrieve pets left behind.

Local Events – Superfund Sites

St. Croix County has five active Superfund properties listed in the EPA Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) database, none of which are on the National Priority List (NPL). There are 11 additional archived Superfund sites in the County for which no further Federal assessment, remediation, monitoring, or other activities are planned. The five active Superfund properties are:

- Rosen Metal Inc (Baldwin) – This scrap metal and former battery site was partially cleaned-up in 1993-1996. Currently, no further remedial action is planned. Related to this property is the Lee Farm site nearby in the Town of Eau Galle where batteries from Rosen Metal were dumped. At this time, remediation is complete at the Lee Farm site and a long-term groundwater monitoring program is in place.
- Junkers Landfill (Hudson) – Remedial investigation and a feasibility study of the site were completed in 1996 and a final remedy selected. This site is part of a well-advisory area in which whole house carbon filters are recommended for private residences. No further remedial action is planned.
- Seversen Salvage (Cady) – This is a 30-acre property with approximately 100 cubic yards of printed circuit boards and other scrap materials; lead contamination is a concern, but any contamination is believed to have been limited to the site. It was identified as a "removal only" site and a full site assessment was not performed. The site was referred from EPA to WisDNR for remedy.
- New Richmond Landfill (License #2492) – This landfill operated from approximately 1975 through early 1992, at which time it was capped with two feet of final cover material and six inches of top soil. First reported to the EPA in 2002, the preliminary assessment states that this former municipal landfill northwest of the City has impacted 14 private wells in the Town of Star Prairie with volatile organic compounds (VOCs), with some trace amounts found in wells further north. Analysis of remedial alternatives is underway, with the likely permanent replacement of water supply in the effected area by extending municipal water from the City of New Richmond. Whole house carbon filters have been installed in approximately 15 homes in the well advisory area as a temporary mitigation measure.
- Town of Warren TCE (tetrachloroethylene) Site – This site was first reported to the EPA in 2004, and is part of the same well advisory area of the Junkers Landfill. According to the initial discovery, groundwater contamination by TCE has impacted several nearby private wells near the suspected source area. TCE contamination has been documented as far back as 1984. The suspected source is not known, but may be related to illegal dumping in the past. TCE is known to cause cancer and damage the nervous and immune systems. Children and seniors are especially vulnerable to TCE's toxic effects.

Local Events – Toxic Release Inventory (TRI) Sites

Facilities in certain industries which manufacture, process, or use significant amounts of toxic chemicals are required to annually report on their releases of these chemicals. More specifically,

facilities with ten or more employees that process more than 25,000 pounds in aggregate, or use greater than 10,000 pounds of any toxic chemical in a given year are required to report releases each year to the Toxic Release Inventory (TRI) database. Releases include any toxic chemicals spilled, discharged, injected or otherwise released into the air, land, water, or underground.

As shown in Table 27, over the last 20 years, the number of facilities in St. Croix County reporting releases to the TRI database has been fairly constant, with a range of 5 to 8 reporting facilities in any given year.

TABLE 27. Reported Toxic Releases – 1987 to 2004
St. Croix County

Year	# of reporting facilities	Total Onsite Releases (lbs)	# of facilities w/ over 10,000 lbs released
1987	6	37,733	2
1988	6	67,160	1
1989	5	40,562	2
1990	5	35,971	2
1991	6	66,703	2
1992	6	241,838	3
1993	6	181,721	3
1994	6	150,517	4
1995	6	172,460	4
1996	8	160,525	4
1997	6	176,676	5
1998	4	109,109	3
1999	7	116,508	4
2000	6	70,251	2
2001	8	147,891	4
2002	8	117,843	5
2003	6	61,580	3
2004	6	50,333	2
'00 to '04 avg.	6.8	89,580	3.2

Source: EPA's TRIS database, search using www.rtknet.org, 2/20/07.

During the timeframe of Table 27, the total amount of onsite releases peaked during the 1990s and has since slowly declined overall. The reporting facilities are located throughout the County and not confined to a single area or closest to the higher population communities. From 2000 to 2004, Donaldson Co, Inc., in Baldwin, had the highest amount of total releases consisting of xylene which is a common chemical found in petroleum which is often used as a solvent or cleaning agent. Nitric acid releases via land treatment is a common byproduct from the Cady Cheese Factory near Wilson. During the 1990s, Foremost Farms USA Cooperative near Wilson had some of the largest releases of nitrates or nitric acid, but their releases have decreased considerably in recent years. Other facilities with relatively substantial annual releases between 2000 and 2004 are the McMillan Electric Company in Woodville and Kolpak-River Falls Division in River Falls, which changed ownership in 2002 and has not had a reported release since that time.

It must be stressed that some type of inappropriate action should not and cannot be insinuated or implied when a facility appears in the TRI database. In most, if not all, cases, the releases reported are in compliance with applicable regulations and are consistent with the appropriate management plans. The far majority of releases in the TRI database are not accidental spills, but could be considered part of normal business practice under current regulations.

Local Events – BRRTS Records

The Bureau for Remediation & Redevelopment Tracking System (BRRTS) keeps data on hazardous materials releases and the clean-up of contaminated sites and is maintained by the Wisconsin Department of Natural Resources. The BRRTS system categorizes these events by activity type. As shown in **Table 28** below, there are 687 BRRTS records for St. Croix County from 1976 to the present. Of these, 35% are open or conditionally closed.

TABLE 28. BRRTS Records – 1976 to 2007[18]
St. Croix County

Activity Type	1976-2007		2000-2007	
Environmental Repair (non-LUST)	53	8%	11	7%
General Property Information	5	1%	4	3%
Leaking Underground Storage Tanks	192	28%	20	13%
No Action Required Discharge	94	14%	19	12%
Spills	315	46%	82	53%
Liability Exemptions (VPLE)	1	0%	0	0%
Removed from Database	27	4%	19	12%
Totals	687	100%	155	100%

Two activity types are particularly important—leaking underground storage tanks (LUSTs) and environmental repair (ERPs) sites. A **LUST** site has contaminated soil and/or groundwater with petroleum, which includes toxic and cancer-causing substances. However, given time, petroleum contamination naturally breaks down in the environment (biodegradation). Some LUST sites may emit potentially explosive vapors. **ERP** sites are sites other than LUSTs that have contaminated soil and/or groundwater. Examples include industrial spills (or dumping) that need long term investigation, buried containers of hazardous substances, and closed landfills that have caused contamination. The ERP activities include petroleum contamination from above-ground (but not from underground) storage tanks. Unlike spills which are typically reported and cleaned up quickly, LUST and ERP sites many times are undiscovered or go unreported for long periods of time until after significant contamination occurs.

Since 1976, 36% of the BRRTS reports were either leaking underground storage tanks (LUST) or other environmental repair (ERP) projects. About 46% were hazardous materials spills. More recently since 2000, the percentage of spills has increased to 53%, largely due to a significant decrease in the proportion of LUST reports. The percentage of environmental repair projects decreased slightly. For reference, the Environmental Repair and LUST sites with locations

[18] Wisconsin Department of Natural Resources, WDNR BRRTS on the Web, http://botw.dnr.state.wi.us/botw/Welcome.do

provided on the WisDNR Remediation & Redevelopment Sites Map are shown on **Figure 18** later in this section.

Local Events – Recent Hazardous Materials Spills

Spills are defined as a discharge of hazardous substance that may adversely impact, or threaten to impact, public health, welfare, or the environment. Spills are usually cleaned up quickly when reported, though many smaller spills likely go unreported. As discussed in the previous subsection, spills have been an increasing percentage of the hazardous materials incident activities in the County.

Between 1996 to 2004, 45 hazardous materials spills in St. Croix County were reported to the Hazardous Substances Emergency Events Surveillance (HSEES) system through the Wisconsin Department of Health & Family Services as shown in **Table 29** below. These spills were accidental or illegal in nature, as opposed to the majority of releases in the TRI database discussed previously in Table 27.

TABLE 29. Reported Hazardous Materials Spills – 1996 to 2004[19] St. Croix County

Year	# of Reports	Actual Release	Threatened Release	Fixed Facilities	Transportation Related
1996	3	3	0	3	0
1997	0	0	0	0	0
1998	4	4	0	2	2
1999	5	5	0	2	5
2000	3	3	0	0	3
2001	5 (2)	3	2 (2)	4 (1)	1 (1)
2002	5 (1)	3	2 (1)	2 (1)	3
2003	13 (10)	3 (1)	10 (9)	11 (9)	2 (1)
2004	7 (3)	4	3 (3)	6 (3)	1
Total	**45 (16)**	**28 (1)**	**17 (15)**	**30 (14)**	**17 (2)**

NOTE: Numbers in parentheses are methamphetamine related.

The most notable trend in Table 29 are the number of methamphetamine-related releases in recent years. In 2003 and 2004, 65% of the reports were related to methamphetamine labs. All but two of the "meth" reports were at fixed facilities and only one of the reports involved an actual release. Ten of the 16 meth-related reports occurred at sites within ¼ mile of residential areas and most of these reports involved more than one toxic chemical with ammonia being the predominant concern. There were no immediate injuries associated with these reports. Efforts to combat meth labs and meth addiction during the past decade have been having success, with the number of discovered labs in Wisconsin decreasing.

Of the other 29 reports, sixteen (55%) were at fixed facilities while thirteen (45%) were transportation related. All transportation-related releases were ground based, with none involving train derailment or pipelines. Almost all of these reports (27 of 29) involved actual

[19] U.S. Dept. Health & Human Services, Agency for Toxic Substances & Disease Registry, HSEES database, http://www.atsdr.cdc.gov/HS/HSEES/Public_Use_Data.html.

releases. Twelve of the releases (41%) occurred within ¼ mile of a residential area. For those release records with an associated cause in the database, the highest number of these releases were due to operator error at 36%. Equipment failure was the next most common cause at 32%. The number of deliberate releases (non-meth related) was at 18% due to improper disposal of toxic materials.

Overall, with the exception of the meth-related reports, the number of accidental or illegal hazardous materials releases has stayed fairly consistent at about four reports per year. But as traffic volumes increase, population increases, and development occurs, it is also expected that the number of accidental hazardous materials incidents could also increase.

Local Events – Key Areas of Groundwater Contamination Concern

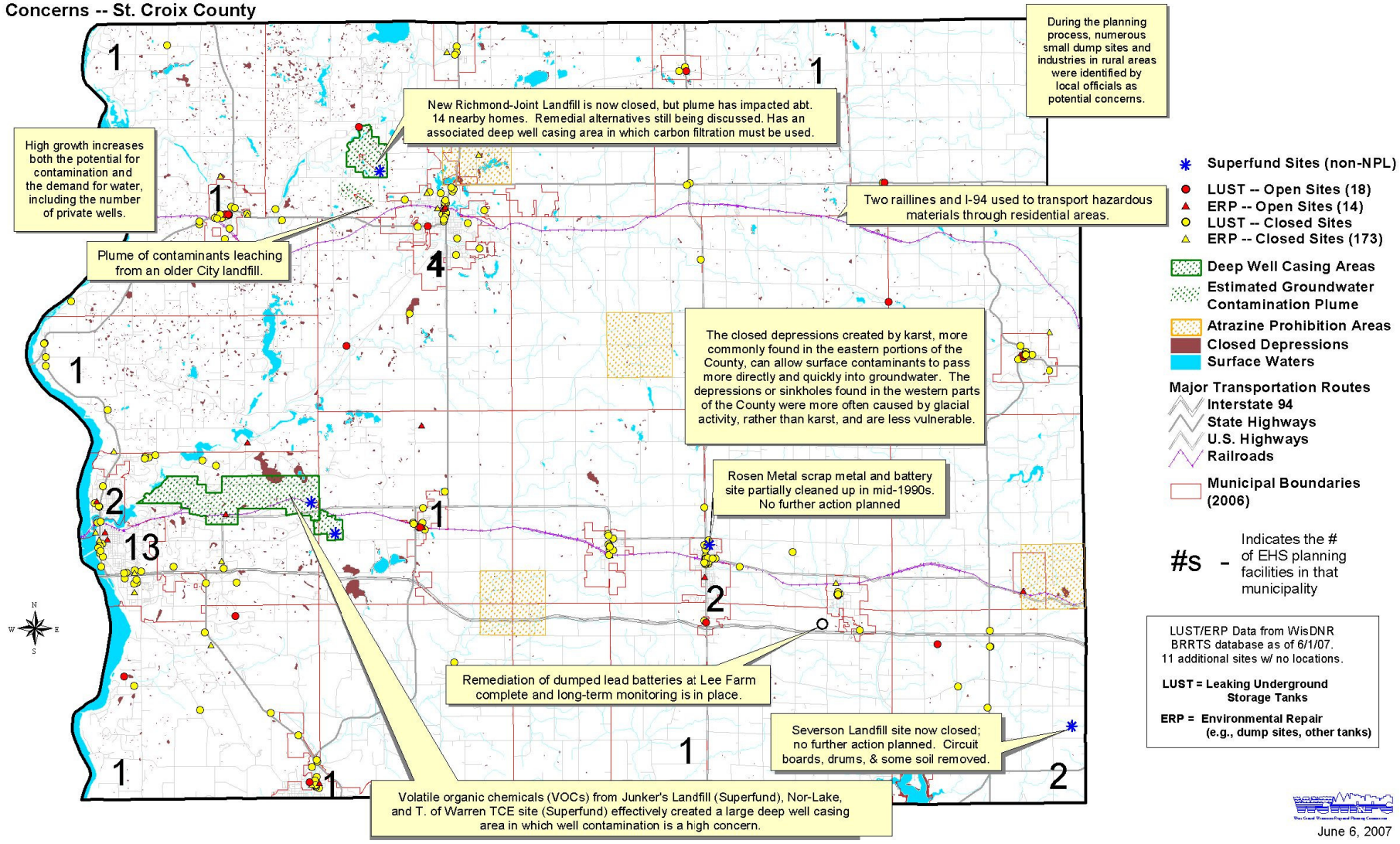
Figure 18 on the following page identifies the key areas of groundwater contamination concern, including the previously mentioned five Superfund sites, as well as the Lee Farm site. And for reference, the map shows the four atrazine prohibition areas in which groundwater contamination from atrazine pesticide use has exceeded State enforcement standards, though non-point sources of contamination are generally outside the scope of this planning effort.

To provide a sense of the number and distribution of potential brownfield and remediation sites in the County due to past hazardous materials dumping, storage tank leaks, or other such contamination requiring action, Figure 18 also identifies the open and closed LUST and Environmental Repair sites in the County[20]. All of these sites have had some level of contamination to varying degrees, most often limited to the site itself.

Figure 18 also shows the two general areas which the Wisconsin DNR has designated as deep-well casing areas due to groundwater contamination. These areas are actually four individual areas, three of which are related to the previously mentioned Superfund sites in which Volatile Organic Compounds (VOCs) have caused significant groundwater contamination. Long-term exposure to VOCs can include cancer, liver damage, spasms, and impaired speech, hearing, and vision. Each of these areas has related requirements for private wells, such as increased testing and the installation of whole-house, point-of-entry, activated carbon filter treatment systems. In some cases, landowners have elected to use bottled water, while the extension of municipal water is being planned for the Town of Star Prairie area.

[20] Geo-locations for LUST and Environmental Repair sites taken from the Wisconsin Department of Natural Resources Remediation and Redevelopment Sites Map as of June 1, 2007. Eleven additional sites are known but do not yet have an associated geo-location and are not shown.

FIGURE 18.
Key Groundwater Contamination Concerns -- St. Croix County



Also on Figure 18 is a very approximate potential impact area of a second plume of groundwater contamination in the Town of Star Prairie from a second, older landfill. Landfill license #310 is reported to have operated from approximately 1945 until it closed in 1975. In 1992, an Environmental Conditions Assessment was completed and based on the results of that assessment, one private well was replaced because of VOC contamination and the landfill was capped in 1994 with clay material. Since that time, Operation & Maintenance (O&M) continues at the site with scheduled water sampling from monitoring wells and private wells. This second plume has not been declared a deep-well casing area or other formally identified well advisory area. However, the Wisconsin Department of Natural Resources may require additional actions at this site in the future.

Figure 18 also shows known areas of closed depressions and the number of extremely hazardous substances (EHS) planning facilities in each community. These potential vulnerabilities will be discussed further in the vulnerability assessment subsection. During the planning process, a number of small dumpsites and industries in rural areas were also identified as potential areas of concern by local officials, but such sites were too numerous to comprehensively identify and map under the scope of this planning effort. A smaller mobile home park in the Town of Stanton just outside the City of New Richmond was identified as having significant problems with septic systems.

For a more complete analysis of the County's groundwater, please reference the reported entitled "An Introduction to Groundwater in St. Croix County" completed in May 2006 by the UW-Extension and UW-Stevens Point. This report offers insight into a broader range of water quality measurements, such as nitrates, triazine, arsenic, chloride, hardness, and pH, which were generally outside the scope of this mitigation planning effort which focuses only on potential point sources of contamination. The USGS is currently leading a groundwater modeling effort which includes St. Croix County which will lend additional insight into the characteristics of groundwater in the area and will help guide future studies and mitigation strategy.

Relative Level of Risk

There is no area of St. Croix County which is immune to hazardous materials incidents and such incidents will continue to occur. The frequency of hazardous materials-related events were rated as moderate by the County steering committee for this planning effort.

Based on past trends, 5 to 8 industries will report releases of hazardous substances into the environment in any given year as reported to the toxic release inventory (TRI). Most of these releases are part of normal standard practice for the industry and in compliance with applicable regulations.

Approximately 10 to 12 hazardous materials spills will be reported in any given year in the County for the near future based on the BRRTS data, though the number of more significant spills will likely range between 6 and 8 per year based on the HSEES data. A significant number of these spills are methamphetamine-related however, and they may substantially decrease in number if meth production also decreases in the County. Less common are the reported leaking underground storage tanks (LUSTs), which are expected to continue to range between 2 and 3 new reports per year based on the BRRTS data.

Of greatest concern are the environmental repair projects for contaminated sites other than LUSTs, such as illegal dumpsites, closed landfills, buried containers, or large industrial spills. Such sites have the largest potential for environmental impact, as reflect by the Superfund sites and deep-well casing areas already existing in the County. Environmental repair sites have the highest likelihood of requiring a long-term investigation and significant remediation measures. Based on BRRTS data, new environmental repair sites will be reported for the County at an average of 1 to 2 per year, though not all will require significant remediation activities.

For the communities of St. Croix County, the most commonly noted hazardous materials concern of local officials is the movement of such substances through communities via semi-truck or rail line. There is no history of hazardous materials spills involving railways in the County; though such a risk is possible, it cannot be reliably predicted and should not occur if rail lines are well maintained and accidents at rail crossings are avoided. Of all spills, approximately 38% were transportation related, so this is a more significant risk. Based on past trends, one to two such transportation-related spills can be expected to occur in any given year.

The level of risk is also influenced by the fast pace of growth in St. Croix County. As more growth occurs, there is an increase in the potential number of contamination sources. And, as the number of industries increases, there is an increase in the general use of hazardous materials in the County for domestic, institutional, and commercial purposes. Traffic volumes also rising, which increases the potential for accidents involving vehicles carrying hazardous materials. Further, as additional private wells are installed, more residents are potentially vulnerability to groundwater contamination. It can be expected that the frequency of hazardous materials incidences and spills in the County will slowly increase as the County's population continues to rise and development occurs.

These risks aside, well tests as part of a May 2006 study[21] for the County revealed that the majority of over 2,000 private wells tested in St. Croix County had water that is similar or possibly even better in quality than bottled water that is sold in stores. This fact supports local efforts to protect the excellent groundwater quality found in most areas of the County.

Vulnerability Assessment—Hazardous Materials

Potential Impacts

Hazardous substances and materials can have a wide variety of harmful impacts to people, property, and the environment. These substances can be in solid, liquid, gaseous, or semi-solid form, which can often be difficult to detect or contain if a release does occur. Impacts may be immediate, as in the case of fire, explosion, or physical harm to bystanders (e.g., fire, inhalation, chemical burns, radioactivity). And some impacts can be longer term, such as degraded water quality, illness among wildlife, corrosion, or increases in health problems (e.g., cancer, birth defects). The magnitude of the vulnerability zone and potential for fire or explosion also varies by substance type (e.g., gas vs. solid) and by environmental conditions (e.g., wind speeds, access to surface or groundwater, temperature). In extreme cases, contamination of buildings and soils

[21] UW-Extension and the Center for Watershed Science & Education at UW-Stevens Point. "An Introduction to Groundwater in St. Croix County". May 2006.

can be at such levels to make a property unusable or uninhabitable for lengthy periods. Evacuation of nearby residents may be needed. Recovery and clean-up costs can also vary widely depending on the type of hazardous material, amount released, and conditions at the site (e.g., soil type, temperature). And, as the fastest growing County in Wisconsin, the potential for, and vulnerability to, hazardous materials incidents continues to increase as the population increases.

There are many available resources which discuss the potential impacts of the release of hazardous substances. One such source is the Agency for Toxic Substances and Disease Registry's HazDat database which can be found on-line at http://www.atsdr.cdc.gov/hazdat.html. HazDat, the ATSDR's Hazardous Substance Release/Health Effects Database, is the scientific and administrative database developed to provide access to information on the release of hazardous substances from Superfund sites or from emergency events, as well as on the effects of hazardous substances on the health of humans.

St. Croix County Hazardous Materials Storage & Use Facilities

According to data from Wisconsin Emergency Management for 2006, there are 86 Tier Two reporting facilities and 32 Extremely Hazardous Substances (EHS) planning facilities within St. Croix County. These facilities represent significant potential sources for a hazardous materials incident, with the EHS facilities being the greater concern. The number of EHS facilities by municipality is shown on Figure 18.

Tier-Two facility reports are submitted annually, by law (SARA Title III), for any facility that is required to prepare or have available a Material Safety Data Sheet (MSDS) for a hazardous chemical present at the facility. EHS (Extremely Hazardous Substances) facilities store and/or use one of over 300 chemicals with extremely toxic properties identified within Title III of SARA. In addition to the MSDS reporting requirements, EHS facilities must cooperate with St. Croix County Emergency Management and the Local Emergency Planning Committee (LEPC) to develop an emergency response plan.

The MSDS must identify any hazardous chemical present at the facility at or above 10,000 pounds at any given time or for each extremely hazardous substance (EHS) at or above 500 points (or the threshold planning quality, whichever is less) at any given time. There are a number of exemptions from these reporting requirements, including retail gas stations, hazardous wastes regulated under the Resource Conservation and Recovery Act, substances used in routine agricultural operations by the end-user, tobacco products, wood products, food products regulated by the Food & Drug Administration, and hospitals.

Of the 32 EHS planning facilities, 23 were located in incorporated areas, assumingly with access to municipal water and sewer. And from a cursory review, the far majority of tier-two facilities were also located in incorporated areas. In addition, the previously noted FEMA HAZUS database includes 205 records of hazardous materials facilities in St. Croix County drawing this information from a variety of sources, though some of the records are duplicated or may be outdated[22]

[22] Hazardous materials facilities noted in the HAZUS database were taken from the Toxic Release Inventory, Resource Conservation Recovery Information System, Air Facility System, CERCLIS, PCD Handler Activity Data System, Permit Compliance System, and the Section Seven Inventory System.

These facilities have no unique, inherent characteristics (e.g., location, type of construction) which made them any more vulnerable to the hazards covered within this Plan when compared to other manufacturing facilities, and thus were not individually analyzed. However, the hazardous nature of the chemicals and substances used or stored at these locations can pose unique vulnerabilities to local residents and the environment.

Closed Depressions

The "Closed Depression Map of St. Croix County, Wisconsin" provides an excellent description of the phenomena of closed depressions in the County as paraphrased in the *St. Croix County Development Management Plan* completed in 2000:

> *Closed depressions are common features in St. Croix County. They have formed through two quite different geological processes: karst development and glaciation. Karst development occurs in regions with highly soluble bedrock and results in distinctive landforms such as sinkholes. St. Croix County is covered by several rather thick, soluble carbonate units, and has particularly well developed karst, especially in the eastern half of the county. Glacial action can also result in topography marked by closed depressions known as kettles or kettleholes. Kettles develop when large blocks of glacier ice are buried within glacial deposits and subsequently melt. Many of the depressions in the western and northwestern portions of the county are kettles that developed in the St. Croix moraine after it was deposited during the Wisconsinan glaciation.* - Baker, Hughes, Huffman and Nelson, Closed Depression Map of St. Croix County, Wisconsin, 1991

Closed depressions (or sinkholes) are significant groundwater contamination vulnerabilities since there are sometimes minimal soil layers between the bottom of the depressions and the bedrock underneath. Contaminants at the surface are not given the opportunity to be adequately filtered by soils, but, instead are passed more directly from the surface to the groundwater aquifer. And given the nature of bedrock fractures and aquifers, contaminants can travel large distances in relatively short timeframes.

The karst topography more common in the eastern half of the County is more vulnerable to groundwater contamination since this is often in areas characterized by thin soils or surficial deposits. With the closed depressions or kettles created by glacial activity, more common in the western and northwestern parts of the County, there is typically greater amounts of soil layers between the depression and the bedrock to provide additional filtration of potential contaminants.

Most of the known closed depressions in St. Croix County are shown in Figure 18, though some are so small to be hardly noticeable on the map. Many others likely exist, but have not been discovered or formally mapped, since these depressions can be difficult to identify. On occasion, these depressions or sinkholes have been used for convenient dumping sites for a variety of potential contaminants, such as lead batteries. Closed depressions are also many times used as natural drainageways or stormwater ponds, though often without adequate buffer areas.

Vulnerable Critical Facilities

All critical facilities have some related vulnerability to the release of a hazardous or toxic substance. Three types of critical facilities in particular were identified as being most vulnerable to the impacts of hazardous materials releases:

- Community Wells and Wastewater Treatment Systems
- Private Wells
- Transportation Systems

Wells for potable, drinking water are especially vulnerable to groundwater contamination, especially private ones which are typically tested less frequently than their public counterparts and do not have associated wellhead protection programs. Contamination may be from point sources (a spill or release) or may be more indirect, such as the application of atrazine pesticides over time within a wellhead draw area.

As of May 2006, St. Croix County had 151 public water systems which had at least 15 service connections or serves an average of at least 25 individuals daily at least 60 days out of the year. Of these, 11 where municipal systems, with numerous communities planning to construct new wells in the near future to keep up with the pace of growth. As the population increases in the County, the number of new private well permits each year has also been significantly increasing. In 2004, almost 800 new wells were constructed in St. Croix County, which is a 129% increase from the 350 new wells constructed in 1994.[23]

Wastewater treatment systems can also be impacted by the introduction of chemicals or hazardous materials. Dissolved oxygen levels can change and the biological treatment of effluent can be impacted. Keeping a municipal treatment system balanced and operating efficiently can be a challenge, especially when there are sudden changes in the effluent entering the treatment plant.

Transportation-related hazardous materials spill near the Village of Roberts

- While transportation infrastructure may not be physically impacted by a hazardous materials spill, the use of the infrastructure and nearby land uses can be impacted. A wide variety of chemicals move through and within St. Croix County via railroad and truck traffic. If a spill should occur, adjacent residents, travelers, buildings, water supplies, and ecosystems can be impacted. And as response and clean-up proceeds, these transportation routes may need to be temporarily closed and nearby homes, businesses, and structures evacuated.

[23] UW-Extension and the Center for Watershed Science & Education at UW-Stevens Point. "An Introduction to Groundwater in St. Croix County". May 2006.

As shown in Figure 18, rail lines pass through portions of most incorporated communities in the County, with the exceptions of Deer Park, Glenwood City, and River Falls. And, as discussed previously in the review of regional events, the Wisconsin Central line is the same railroad which had a derailment in 1996 resulting in the evacuation of about 2,300 people in the Weyauwega area. Likewise, the Interstate 94 corridor also travels through numerous incorporated and developing areas in the County. This is the second most heavily traveled segment of interstate highway in the State, with over 65,000 vehicles per day at its western end and increasing. It is also a regional truck route which moves significant amounts of hazardous materials. As traffic volumes increase on Interstate 94 and other roadways in the County, the potential for accidental spills of hazardous materials increases.

It must also be noted that law enforcement personnel and emergency response providers are also vulnerable to the potential impacts of toxic releases as they respond to an incident or situation. In 1999, two responders in St. Croix County did receive respiratory injuries during a transportation-related hazardous materials incident.

Unique Jurisdictional Risks or Vulnerabilities—Hazardous Materials

During meetings with local municipalities and key informant interviews, the following items elated to hazardous materials were particularly noted regarding incorporated areas:

1) the transport of hazardous materials or unidentified chemicals, especially through residential areas;

2) the protection of groundwater and community wellhead zones of contribution;

3) the potential contamination of surface waters, especially from hazardous materials within floodplain or near surface waters; and,

4) 75% of the EHS planning facilities in the County are located in incorporated areas, with 41% located in the City of Hudson.

Appendix G reviews the hazardous materials issues for participating communities. Most communities have implemented wellhead protections programs for their municipal wells. As previously mentioned, most communities also lie on rail lines, while Interstate 94 passes through four different incorporated areas—Hudson, Roberts, Baldwin, and Woodville. Also notable is that a large portion of the Village of Wilson lies within the atrazine prohibition area.

However, it is the City of New Richmond which currently has the most significant issues regarding past hazardous material contamination due to its ownership responsibilities related to the two leaking landfills in the Town of Star Prairie. While the contamination may not be impacting City water supplies, the City has an important role in remedying these problems.

viii. Nuclear Accident

A nuclear accident category was added to the scope of the *St. Croix County All Hazards Mitigation Plan* given the County's proximity to the Prairie Island Nuclear Generating Facility near Red Wing, MN. Sources of information for this section of the plan include: Wisconsin Emergency Management interviews, various hazard mitigation plans from other communities, Nuclear Management Company (NMC) interview and website, interview with the State Radiological Coordinator, Wikipedia, various FEMA fact sheets, and the *St. Croix County Emergency Operating Plan—Radiological Annex.*

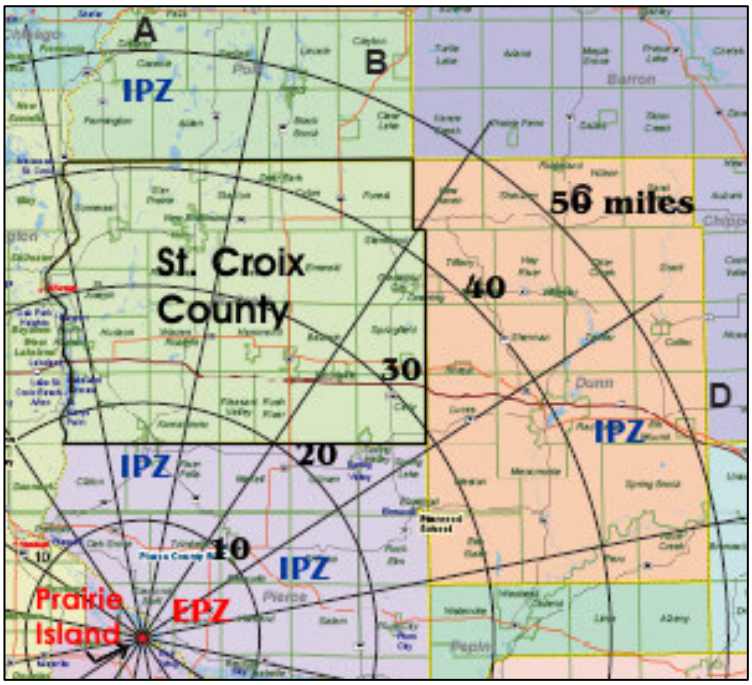
Risk Assessment—Nuclear Accident

The Hazard

In the context of this plan, a ***nuclear accident*** (or radiological hazard) is the uncontrolled release of a radioactive material from a fixed nuclear facility that can harm people or damage the environment.

Accidental radiological releases can occur anywhere radioactive materials are stored, used, or transported. Such a release may vary in scale, location, and potential damage. A small radioactive release may occur at a nuclear medicine or science facility, or a release could occur along the interstate or railroad tracks when a vehicle transporting radioactive material is involved in an accident. These events would likely be smaller in geographic scale and impact, with risks, vulnerabilities, and emergency response actions comparable, if not identical, to those of the chemical, biological, or other hazardous materials spills discussed in the previous subsection.

FIGURE 19. Prairie Island Nuclear Generating Facility EPZ & IPZ



base map from State of Minnesota – Division of Homeland Security and Emergency Management

This section of the report focuses on the accidental radiological release from a fixed nuclear facility. ***Fixed nuclear facilities*** are complexes in which fissionable fuel is stored or used for such functions as electrical power generation. St. Croix County has no fixed nuclear facilities within its boundaries. However, it is located within the 50-mile Ingestion Pathway Zone (IPZ) of the Prairie Island Nuclear Plant located to the south near Red Wing, MN (*see **Figure 19***).

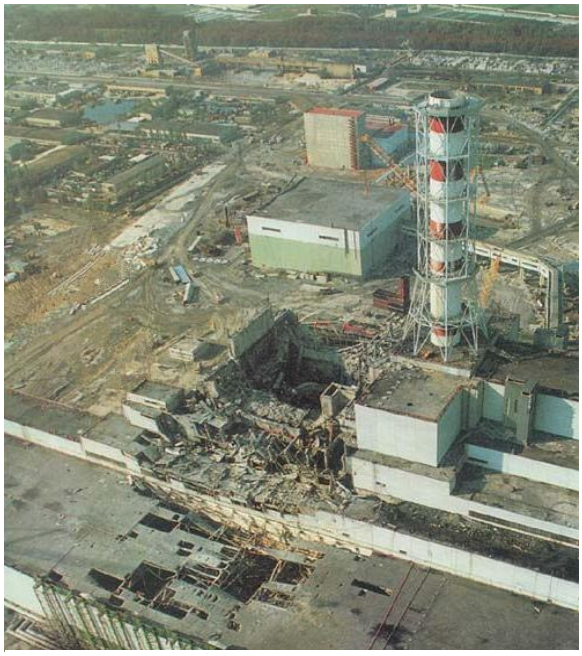
The ***Ingestion Pathway Zone*** (IPZ) is the potential pathway of radioactive materials to the public through consumption of radiological contaminated water, food crops, or dairy products. By law, this special emergency planning areas extends 50 miles in a radius from the Prairie Island Nuclear Plant. An accidental release at the Prairie Island Plant could be in the form of a "plume-cloud," which disperses airborne radioactive materials and contaminating areas within 50 miles of the facility. This can potentially be a long-term problem for the IPZ, as contaminates could enter the soil and then be absorbed into plants which might enter the food chain of people and animals. If a release should occur, aggressive testing and monitoring of vegetation, water, milk, food products, and wildlife would take place within the IPZ to ensure radioactivity falls within safe levels as established by the Food and Drug Administration.

It is important to note that a nuclear plant cannot explode like a nuclear bomb. Nuclear plants do not have the right concentration of radioactive materials in sufficient quantities to produce a nuclear explosion. For St. Croix County, the primary hazard that the Prairie Island Nuclear Plant presents is a potential airborne release of radioactive materials which could contaminate the soil and food supply.

Historical Events

The only major accident at a commercial nuclear power plant in the United States occurred at Three Mile Island in Pennsylvania in 1979. Operator error and a minor mechanical malfunction combined to damage the nuclear reactor core. A serious release was avoided, although some radiation was detected up to 20 miles from the facility. Located approximately 200 miles from New York City, the Three Mile Island nuclear plant has now been shut down.

Likely the worst nuclear disaster in the world occurred at the Chernobyl Nuclear Power Plant near Pripyat, Ukraine, on April 26, 1986. An explosion at the plant and resulting dispersal of radioactive contamination required the evacuation and resettlement of over 336,000 people. Contamination was detected throughout much of Europe. In Sweden, contaminated milk was diluted with uncontaminated milk to dilute radioactivity to acceptable health levels.



Chernobyl Nuclear Plant
widely distributed photo following the explosion from: en.wikipedia.org/wiki/Chernobyl accident

Given Soviet cover-up attempts, it is difficult to determine the likely impacts. According to a 2005 report prepared by the Chernobyl Forum, there were fifty-six direct deaths (mostly accident workers) and as many as 9,000 people of the estimated 6.6 million most highly exposed may die of cancer.[24] Other recent studies predict anywhere between 30,000 to 93,000 likely related fatalities in time. The soldiers

[24] http://en.wikipedia.org/wiki/Chernobyl_accident from International Atomic Energy Agency Report *In Focus: Chernobyl*.

and workers (called "liquidators") sent in by the Soviet government for initial clean-up have had the highest rate of mortality and sickness, with an estimated 10% of the 600,000 deceased and 165,000 disabled, according to Union Chernobyl.

As of 2000, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) estimated that the number of thyroid cancer cases linked to the Chernobyl disaster has risen to about 1,800. A 2006 Physicians for Prevention of Nuclear Welfare report estimated over 10,000 people are affected with thyroid cancer, with 50,000 case expected, and attributed increases in deformities and newborn mortality rates in Europe to Chernobyl's radioactive discharge. Other studies allege similar links, such as heightened mortality in Sweden. While a 2006 study by the French Institute of Radioprotection and Nuclear Study could not identify a clear link between Chernobyl and cancer rates in France, it acknowledged that reported papillary thyroid cancer had tripled in the years following the event. Most of the long-term expected impacts have not yet occurred, so it is difficult to estimate and will be a challenge to measure the overall impacts.

A 30-kilometer (18.6 mile) exclusion zone was established around the Chernobyl site to prevent people from entering the most heavily contaminated area, except for scientific study, day tours, and operations of the Chernobyl facility. However, dozens of peasants and others either refused to be evacuated or illegally returned to the zone, for which authorities have now become reconciled after multiple attempts at expulsion. These individuals either deny or are resigned to the health risks and accept that available services are now very limited.

While a tragedy, the Chernobyl accident brought great attention to nuclear plant operations and safety, in particular to those plants within the former Soviet Union. Significant knowledge on the impacts of radioactive fallout on the environment and human populations has been gained, and measures to remediate the impacts are being studied and attempted. And floura and fauna within the exclusion zone has increased in diversity due to the reduction in human activity.

Closer to home, no nuclear generating plant managed by the Nuclear Management Company has ever approached the radiation limit regulated by the Federal government. Since August 2000, Nuclear Management Company (NMC) has been the operating manager of the Prairie Island Nuclear Generating Plant which is owned by Xcel Energy, Inc. According to the NMC website (www.nmcco.com), the plant houses two pressurized water reactors totaling 1,100 megawatts of capacity. The units have been in commercial operation since 1973 (Unit 1) and 1974 (Unit 2). The website states that Prairie Island is in excellent material condition and has a sustained history of world-class upper quartile performance for nuclear plants operated for more than 20 years. In 1996, the Nuclear Energy Institute (NEI) rated it among the best performing U.S. nuclear plant in two of three benchmarking studies.

However, the plant is not without its detractors. The Minnesota Public Interest Research Group notes on their website (www.mpirg.org) that the Prairie Island facility has had safety violations in the past, problems with flood gates opening, a fire in an electrical box, and problems monitoring during a emergency safety shutdown in 2001.

Relative Level of Risk
The likelihood of a nuclear accident at the Prairie Island Nuclear Generating Plant which directly impacts St. Croix County is considered a **low risk**.

The Prairie Island Nuclear Generating Plant has many safeguards and systems to minimize the chances of an accident. A series of barriers and safety systems within the plant keeps radioactivity from normal operations inside. The building that contains radioactive fuel and the reactor has 3-1/2-foot-thick concrete and steel walls and thick concrete and steel flooring which act as a containment barrier and extends well below the ground. The reactor vessel, where fission takes place, is a thick steel cylinder that contains the fuel assemblies. All U.S. nuclear plants are conservatively designed and built with many safety systems and emergency back-ups. Procedures and emergency plans are also in place to minimize the potential impacts and extent of the release in the unlikely scenario should an accident occur.

The Plan Steering Committee rated the risk (or potential frequency) of a nuclear accident at 1.56 on a scale of 0-to-5. Nuclear facilities in the United States are highly regulated and secured, and if the Prairie Island Nuclear Plant is well operated, well maintained, and well secured in the future, a nuclear accident at the Plant which impacts St. Croix County is not expected to occur.

Vulnerability Assessment—Nuclear Accident

Potential Impacts
The public is exposed daily to controlled and background radiation from a wide variety of sources, such as the natural environment (e.g., radon), cosmic rays, building materials, televisions, and diagnostic X-rays. Government regulations do not allow the public to be exposed to a radiation dose from a nuclear power generating facility of more than 100 millirem per year above natural background levels. For perspective, the average diagnostic x-ray exposes an individual to 40 millirem.

In addition to the size and type of release, four factors are very important in determining potential impacts if a release of radioactive material should occur:

- Meteorological Conditions (weather)
- Distance
- Shielding
- Time

Meteorological conditions would greatly determine where airborne contamination would settle and the concentration of that contamination. These influencing weather conditions include wind speed, wind direction, humidity/precipitation, and how high the contaminants are dispersed into the atmosphere (e.g., air pressure). It is possible that a sizable release could have no impact on St. Croix County depending on the wind direction. And it would likely take many hours, if not days, before airborne radiological contaminants would fully settle.

The greater the distance between the source of radiation and a person, the less radiation received. The greater amount of heavy, dense material between the radiation source and a person can also provide protection. Shelter-in-place or remaining indoors with windows and doors closed can, in some cases, provide an adequate level of protection. And most radioactivity loses its strength

and dissipates relatively quickly, especially when diluted with water (e.g., surface waters, rainfall, high humidity). Limiting one's time spent near the radiation source reduces the amount of radiation received. And in the case of an event, temporary, controlled reentry into a restricted area may be allowed to tend to livestock or other operations.

Given the distance of St. Croix County from Prairie Island, direct exposure of County residents to gamma radiation or inhaling radioactive materials from a plume released during an incident is very, very unlikely. The possible exception would be those County residents who work or travel within the area closer to the Prairie Island facility (e.g., Red Wing, Treasure Island Casino) at the time of a release. Under most circumstances, such direct exposure and impacts would primarily be limited to the area within the 10-mile plume exposure pathway (also called the Emergency Planning Zone).

For the 50-mile IPZ which includes St. Croix County, the radioactive contamination of soil thereby entering the food chain through crops or dairy products is the primary concern. The highest risk is contaminated food products (e.g., milk, crops) from the 10-mile EPZ being transported to dairies, processors, or producers within the 50-mile IPZ and mixing with uncontaminated product.

Less likely, but still possible, would be the contamination of soils and vegetation in St. Croix County from airborne contamination if certain weather conditions exist at the time of the release. This contamination would most likely be in low levels, not requiring evacuation or shelter. In some cases, a general health advisory may be issued recommending food preparation practices or other precautionary measures (e.g., carefully washing and peeling fruit before consumption).

But in a more severe and unlikely scenario, the low levels of contamination could be a more significant health concern over time. Evacuation would still not be required, but a **temporary agricultural hold** would be placed on producers in the contaminated area. Raw materials and food products may be withheld and isolated from the marketplace until sampling is completed and the product is determined to be safe for production or marketing. Producers may be required to not move or harvest commodity and specialty products (e.g., soils, grains, honey, berries).

The Swedish "solution to pollution through dilution" would not be practiced in Wisconsin, especially in regards to dairy. Dairy is the highest priority since radioactive contaminants can quickly move through cattle, children drink a lot of milk, and it can be easily mixed with uncontaminated product. And, if not carefully controlled, the risk of contamination could have long-term disastrous effects on milk marketing through out the State, soiling the reputation of the "Dairy State." Under a temporary agricultural hold, there could be significant losses for agricultural producers in the area.

Under any circumstances, there would be negligible risk to groundwater within the IPZ. Contamination of the surface waters within St. Croix County is also deemed to be a very low risk given expected contamination levels, the potential for dilution, and the southerly flow of most surface waters. Wildlife could be a concern primarily within the 10-mile EPZ, though animal contamination levels and movements will be closely monitored and appropriate remedies or advisories made.

In the unlikely scenario of an accident, it is quite possible that some residents from areas closest to the Prairie Island facility may travel to or through St. Croix County as part of their evacuation. Up to 10,000 Pierce County persons live or work within the 10-mile plume exposure pathway emergency planning zone who may require evacuation if a general emergency occurs. St. Croix County may be asked to help provide assistance to some of these displaced persons.

Response Plans and Activities

A **general emergency** is the most serious level of potential nuclear accident emergency during which local, state, and federal emergency teams would make recommendations to public officials and take other actions to protect the public and facility workers. Less serious incidents may potentially occur at the site in which an **alert** or **site area emergency** is declared and an evacuation of the public for a limited area beyond the facility site may be ordered, perhaps as a precaution. An **unusual event** is the least serious emergency, typically involving a potential minor problem at the plant not involving the release of radiation which is handled by facility workers, but reported due to strict federal rules.

In the event of a site emergency, advisory announcements would be broadcast over local television and EAS radio stations. During a general emergency, additional warning systems will be activated in accordance with established procedures, including emergency sirens and PA systems in those areas closest to the facility. It is expected that only in the case of a general emergency would there potentially be significant impacts upon St. Croix County residents, with the possible exception of any residents who work at or near the facility, or happen to be traveling near the facility (e.g. Red Wing, MN, Treasure Island Casino).

In accordance with the Federal Radiological Emergency Response Plan, the lead federal agency for most radiological incidents at nuclear generating stations is the Nuclear Regulatory Commission (NRC). The NRC coordinates any federal assets that state and local emergency management agencies request, such as the Federal Radiological Monitoring and Assessment Center (FRMAC). State and local plans would also be activated, such as the policies and procedures defined in the *St. Croix County Emergency Operating Plan—Radiological Annex.*

FRMAC's team would be activated immediately to monitor, model, and assess the plume direction and anticipated contamination areas. Monitors attached to aircraft would provide real-time mapping of the movement of airborne particulates which is further supplemented by on-the-ground monitoring. Within 10-12 hours, detailed maps of expected contamination areas would be available allowing further emergency response and action as needed.

Throughout this time, local officials will assist State and Federal agencies in disseminating information to the media, public, agricultural community, and food producers/distributors through general media, brochures, and direct contacts for the appropriate actions as warranted by the event. During the initial phases for St. Croix County, these could include general educational efforts, protective actions such as sheltering livestock, and sheltering-in-place. Each dairy and agricultural processor may need to be individually contacted if a temporary agricultural hold is issued.

After the initial monitoring and a firm model of the extent of the contamination is established, additional information would be issued, such as any needed health advisories, instructions

regarding reentry, insurance procedures, and recovery operations (e.g., how to decontaminate animals, food, and property).

Monitoring of water, air, soils, wildlife, food products, and residents will continue for a lengthy time throughout the region. Local officials would also be needed to assist in monitoring, given their knowledge of the landscape and to help in accessing private lands, surface waters, and milk producers for testing.

Vulnerable Critical Facilities

There are no critical facilities in St. Croix County which are uniquely vulnerable to effects of a nuclear accident. If an event occurs, patient loads at hospitals and clinics may temporarily increase and emergency management personnel and responders may be asked to assist with any evacuees from areas closer to the facility.

Unique Jurisdictional Risks or Vulnerabilities—Nuclear Accident

The incorporated communities of St. Croix County do not have any unique jurisdictional risks or vulnerabilities in the event of a nuclear accident at the Prairie Island facility. Again, distance from the plant would likely affect exposure, so those communities in the southwestern portion of the County (e.g., City of River Falls) may have the most risk of exposure in the County.

SECTION IV.

CURRENT MITIGATION ACTIVITIES

In the context of the hazards facing St. Croix County, it is important to consider the mitigation activities and strategies already implemented. St. Croix County and its municipalities have been proactive in mitigating many of the impacts of hazards, though efforts can vary by community. The following section is an overview of many of the primary mitigation activities that are being carried out within the County and reflects an approach based on communication and inter-agency cooperation. But in no way should this discussion be considered all inclusive of all such current mitigation activities. And some additional mitigation activities specific to a hazard type (e.g., hazardous materials, pandemic flu) are discussed previously as part of their respective vulnerability assessment.

A. ST. CROIX COUNTY MITIGATION ACTIVITIES

This sub-section identifies those mitigation activities implemented by the St. Croix County government, activities in unincorporated areas, or activities for large areas of the County. Specific mitigation activities for individual incorporated areas are described later in this section.

i. Planning and Regulatory Mitigation Activities

Land-Use and Comprehensive Planning

St. Croix County adopted a development management plan in March 2000 and has a grant application pending for the preparation of a comprehensive plan for the County consistent with the required scope of the relatively new Wisconsin Comprehensive Planning Law (1999 Wisconsin Act 9). A number of local communities in the County are working in conjunction with St. Croix County on their individual comprehensive plans and would be participating in this grant-funded effort. At least 2 cities, 2 villages, and 9 towns in the County have previously received comprehensive planning grant funding and have either completed their plans or their plans are currently in development. As part of local plans, communities can help mitigate potential hazard events by guiding development and addressing emergency services issues.

Building Codes and Permits

The statewide code for newer homes in Wisconsin is the Uniform Dwelling Code (UDC), Chs. Comm 20-25 of the Wisconsin Administrative Code, and its adopted references. Building permits for the Uniform Dwelling Code are required for all new one- and two-family dwellings. For three or more attached dwelling units and commercial structures, the Wisconsin Commercial Building Code (CBC), Comm 61-65, applies, which is currently being updated. The CBC is based on models from the International Building Code, the International Mechanical Code, the International Energy Conservation Code, and the International Fuel Gas Code. Together, these codes offer building standards appropriate to Wisconsin which help to mitigate the impacts of weather events, such as design wind loads, snow loads, and plan review. However, the UDC does not cover dwellings built prior to June 1, 1980, accessory building, or mobile (or

manufactured) homes. Mobile homes are subject to Federal standards. Local municipalities may choose to adopt construction and heating standards for older homes.

Towns can either enforce the Uniform Dwelling Code locally or opt for County enforcement. The Villages and Cities individually enforce the UDC within their respective communities. In addition, a Sanitary Permit through St. Croix County is also required for new construction in unincorporated areas. Private wells are inspected for adequate depth and construction, and some re-dwelling and deepening of wells in areas of heavy irrigation has been needed.

St. Croix County Ordinances

County Zoning Ordinance

Seventeen of the County's 21 towns participate in County zoning. The Town of Hudson enforces its own zoning regulations, while the Towns of Cady and Forest remain unzoned. The St. Croix County Zoning Ordinance establishes the typical zoning districts such as exclusive agricultural, single-family residential, highway business, and forestry, as well as some basic standards for manufactured or mobile home parks. Emergency shelters or emergency operating plans are not currently required for County mobile/manufactured home parks, but such planning or shelters can be required as conditions of a special exception permit.

County zoning personnel are not aware of any new mobile home parks in St. Croix County within the last 25 years and current land values discourages such development in many western portions of the County. All of the cities and villages in St. Croix County have adopted and enforce their own zoning ordinances. At least ten of the town governments have adopted their own mobile home park ordinances more restrictive than the County standards.

County Subdivision Regulations – The County's subdivision regulations cover all unincorporated areas of the County and include a site plan review process, stormwater management requirements, and erosion controls. The regulations also provide some basic standards for private roads and the Department works with appropriate emergency services personnel as needed to ensure the safety of road design when regulated by the County. For instance, subdivisions with 30 or more lots are required to include a second road outlet, in part for safety reasons. For land divisions within well advisory areas (e.g., deep well casing areas), certified survey maps and subdivision plats must include disclosures before recording. And, as required on occasion in the past, special studies can be required for the identification of closed depressions.

In addition, ten towns (Baldwin, Cylon, Hudson, Kinnickinnic, Pleasant Valley, St. Joseph, Somerset, Stanton, Troy, and Warren) and all of the villages and cities have adopted local subdivision regulations. The Cities of Hudson, New Richmond, and River Falls, and the Village of North Hudson, have adopted erosion control regulations and management practices as part of their subdivision ordinances.

County Floodplain Ordinance – In order better protect the residents of St. Croix County, and to minimize the loss of property, the State of Wisconsin, under Wisconsin Statute 87.30(1), requires counties, cities and villages to adopt and enforce floodplain zoning. In addition, Wisconsin

Administrative Code NR116, Floodplain Management Program, has been promulgated for the protection of property and public investments from the effects of flooding.

According to a Wisconsin DNR official as reported in a recent insurance study, **a municipality is three times more likely to be sued for not enforcing an existing floodplain ordinance**, rather than being sued over enforcement. Not enforcing an floodplain ordinance when there is knowledge of a potential risk increases liability.

Development within the 100-year floodplain is determined through the use of the Flood Insurance Rate Maps (FIRM) developed by the Federal Emergency Management Agency (FEMA) and site-specific surveys as needed.

In July 2003, the Wisconsin Department of Natural Resources released a revised *Model Floodplain Ordinance* which incorporated a number of changes for clarification and consistency with FEMA policies and recent court rulings. The County's recently updated ordinance is consistent with this new model, but some of its communities have out-dated floodplain ordinances which may not reflect the revised State model.

The existing St. Croix County Floodplain Zoning Ordinance applies to all unincorporated areas countywide and was updated within the last two years. Based on the State of Wisconsin model, the County's ordinance includes policies and standards for the overall floodplain district, the floodway, the flood fringe, and for floodproofing. No mobile homes are allowed to be located in the floodplain. All permit applications are reviewed to determine whether proposed building sites will be reasonably safe from flooding. If a proposed building site is in a floodprone area, all new construction and substantial improvements shall be designed or modified and adequately anchored to mitigate flooding impacts. Development pressure for construction in floodplains continues in some areas, but such development in the floodway is tightly regulated and enforcement of existing floodplain ordinances is improving.

St. Croix County Shoreland/Wetland Ordinance -- Shorelands provide valuable habitat for both aquatic and terrestrial animals and vegetation, and also act as buffers and thus serve to protect water quality. However, shorelands are also considered prime residential building areas because of their scenic beauty and recreational value. Recognizing this conflict, and in order to maintain the environmental, recreational, and economical quality of our water resources, the State of Wisconsin requires counties to adopt and enforce a shoreland ordinance. As required by the State, shorelands are defined as:

- all land within 1,000 feet of the ordinary high water mark of a lake, pond or flowage; or
- all land within 300 feet of the ordinary high water mark of a river or stream or to the landward side of the floodplain, whichever is greater.

Each county must meet or exceed the minimum state standards for shoreland protection. For instance, the St. Croix County Ordinance exceeds the state minimum standard by permitting only certain uses in wetlands of three acres or more within a shoreland zone (*as compared to the State standard of 5 acres*). The identified shoreland areas are based on the standards as defined in the St. Croix County Shoreland Ordinance. The shoreland ordinance establishes shoreland and wetland zoning districts in which uses are restricted, setbacks required, and a land-use run-off

rating established. This is an important stormwater management tool to protect water quality, but also contributes to flood storage and mitigation for some areas.

Lower St. Croix National Scenic Riverway – The Lower St. Croix River has been identified by the State of Wisconsin as an important scenic and recreational waterway for the State and included the river in the National Wild and Scenic Rivers Act. Municipalities with a portion of their area with the Riverway must adopt zoning ordinances to minimize development impacts. The ordinances adopted by St. Croix County not only preserve the scenic and recreational value of the Riverway, but also offer important flood mitigation and erosion controls. However, the Riverway regulations can also limit flood mitigation alternatives which have an aesthetic impact.

Mapping

St. Croix County has established a land information office within their Planning Department. Using geographical information systems (G.I.S.) technology, this office collects, develops, and distributes mapping information for St. Croix County, including maintaining the County's parcel maps. An online land information database is also now available.

An update of the FEMA FIRM maps for St. Croix County are currently underway with final, adopted maps expected to be available in early 2008. Once both the parcel mapping and FIRM map updates are complete, a more accurate flood assessment will be possible. More detailed flood mapping data is available in certain areas, but, overall, the accuracy of the earlier FEMA FIRM maps is considered low. The County Code Administrator has been identified as the National Flood Insurance Program (NFIP) Coordinator for St. Croix County and acts as the County's liaison with Wisconsin DNR and FEMA on NFIP activities.

St. Croix County Land & Water Conservation Department

St. Croix County has an active Land & Water Conservation Department responsible for a variety of educational and enforcement activities to protect the farmlands, waters, and natural resources of the County. Many of their programs focus on mitigating the potential non-point sources of pollution or protecting flood storage areas through activities such as encouraging agricultural best practices (e.g., manure storage & spreading, grassed waterways, livestock siting), sinkhole treatment, streambank protections & stabilization, and well abandonment.

The Department conducts nutrient and pest management workshops to encourage landowners to apply nutrients and pesticides at the UW-Extension recommended rates and at specific time periods to improve surface and groundwater quality. The Department also works in cooperation with UW-Extension to conduct a volunteer private drinking water program on a 4-year cycle to allow for the tracking in changes in drinking water quality throughout the County.

ii. Physical Construction and Renovation Mitigation Activities

Hazard impacts, especially for flooding in St. Croix County, can potentially be mitigated through infrastructure improvements and construction projects. Such activities can range from the construction of stormwater retention ponds to installation of storm shelters to the removal of homes from flood-prone areas. These tend to be very costly projects for which grant dollars are often pursued or required.

In St. Croix County, such projects are often in response to a hazard event, such as those funding requests to FEMA for recovery from stormwater flooding in 2001 and 2002. Most of these projects tend to be road, culvert, and drainage system repairs or repair to the electric power lines, but these activities do not necessarily mitigate future hazards. The County and local municipalities often replace culverts or install rip-rap steep road shoulders at problem areas as time and money allow.

While most recent efforts across St. Croix County have focused on stormwater system improvements, ongoing maintenance of the County's infrastructure and properties is also required. Local utilities have implemented aggressive tree-cutting programs to reduce the frequency of downed power lines, with some power lines being buried in areas prone to weather-related outages.

Storm Shelters

The provision of public storm shelters for tornadoes and very high winds has received significant attention in the past, but this is varies widely by municipality. Some communities such as Glenwood City or Roberts have agreements with a local church or school to use their facilities as storm shelters. Other communities such as Wilson and New Richmond offer municipal buildings as shelters. Some mobile home parks may have shelters, such as the one in Woodville, and the Village of Hammond is working with a mobile home park owner to get a shelter constructed in accordance with the terms of a use permit. A number of other communities felt that most residents had access to basements so that a public shelter is not needed, though this could change if current slab-on-grade construction trends continue in the County.

Floodplain Acquisition and Flood Control

The current emphasis for flood control in St. Croix County is on long-term solutions. This approach includes acquisition of floodprone areas, enforcement of floodplain zoning ordinances, land-use planning, and promotion of the sale of flood insurance.

The Wisconsin Department of Natural Resources has purchased large areas of shorelands, wetlands, and high water table along the Willow River in the Town of Cylon and near lakes in the Town of Stanton which preserves important flood storage areas while mitigating the potential for future floodplain development in that area. The U.S. Fish and Wildlife Service has similarly acquired properties near lakes and rivers in the County, such as along the Willow River, northeast of Bass Lake, and east of Boardman.

Many communities maintain floodprone areas as parks, such as in the Village of Somerset.

Numerous parks and public lands located along rivers and lakes throughout the county also play a flood mitigation role while offering recreational opportunities, such as Glen Hills

County Park, Troy Beach County Park, Willow River State Park, and Eau Galle Recreation Area. In addition, many communities have also preserved high hazard floodplain areas for community parks (e.g., Baldwin, Deer Park, Hudson, North Hudson, Somerset, Star Prairie). If not for public ownership of some of these areas, flooding vulnerabilities in the County would certainly be worse, at a likely cost to taxpayers without the recreational benefits. And the protection of such flood storage areas also have environmental benefits, such as nesting habitat for wildlife and serving as natural filters to help protect water quality.

Of special note, WisDNR and the National Park Service have acquired large areas of floodplain along the St. Croix River and mouth of the Willow River in the Town of Somerset, which likely has done more to directly and indirectly mitigate flood vulnerabilities in the County than any other single action for the long-term by limiting development in these areas while offering flood storage to the benefit of communities and landowners down river, such as in North Hudson, Hudson, Town of St. Joseph, and the Town of Troy.

Many of the dams in St. Croix County play an important role in flood control, though this may be a secondary role for some of the hydroelectric dams. Glenwood City residents, as well as residents further east in Boyceville and Downing in Dunn County all noted that the County-owned Glenwood Hills dams have greatly mitigated their past flooding problems. The Eau Galle Dam at Lake George has largely remedied the chronic flooding experienced in the Village of Spring Valley in the past. All high hazard dams in the County have an emergency action plan, with the plans for the County dams updated annually. Notification lists and evacuation procedures are identified in the plans, with a call list maintained for residents within the dam shadows of any County dams. Automated warning systems are also in place at the Glenwood Hills dams which are visually inspected annually from spring through fall.

Roads and Highway Systems

As need arises, the County Highway Department undertakes road, culvert, and embankment improvements to mitigate stormwater and flooding impacts on local roadways. An engineering analysis for the 100-year flood has been completed for many culverts on County roads. In case of a severe snowstorm or other hazard requiring closure of the Interstate, the Highway Department does have a large, digital message board to direct travelers, however a second message board would be needed to cover both directions.

St. Croix County is also very interested in extending the Minnesota Department of Transportation camera system across the St. Croix River on Interstate 94. This system allows monitoring by highway and law enforcement personnel of the pace of traffic flow, potential accidents, or changes in weather, as well as improving notification to travelers and the general public on any changing conditions. To date, the Wisconsin Department of Transportation has not taken a position on whether this will be allowed.

iii. Emergency Preparedness and Communication Mitigation Activities

St. Croix County Hazard Analysis

Each year, St. Croix County Emergency Management updates its *Hazard Analysis* covering a wide variety of man-made and natural hazards and recommending mitigation actions for each hazard type. Much of this information has been integrated into this document.

Flood Monitoring Systems

The flooding of area rivers and streams is typically a result of persistent heavy rainfall or significant snowmelt during the spring. During these conditions, the County utilizes a combination of resources to assist them in evaluating the potential flood conditions. St. Croix County Emergency Management and the National Weather Service are used to obtain information on the potential flood conditions. This information is used to predict the crest of rising waters and time of the crest. The public is informed of changing conditions and predictions through an incident command system. This provides public awareness and notification. Typically, in this situation there is not an urgent, immediate need to evacuate people quickly. When it is determined that an area will be inundated by floodwaters, the residents are notified by public service agencies that are monitoring conditions and people can typically evacuate with their own resources. Emergency service agencies ensure that notifications are received in the local area through announcements and door-to-door contacts as determined necessary.

When conditions are favorable for a flash flood, the National Weather Service issues a warning alerting people to the potential through radio, television, and weather alert radios. Conditions are monitored by emergency service agencies. When conditions begin to threaten an area, residents are notified through press releases and press interviews. Law enforcement and other emergency service agencies also notify residents of the advancing flood using public address systems on emergency vehicles and through door-to-door contacts. Since flash flooding can occur quickly, people are alerted as early as possible of the flood potential so they are aware and watchful of changing conditions. The observations of law enforcement and fire agencies assist in determining the timing and need for evacuations.

Communications

The St. Croix County Emergency Communications Center provides the vital communications link between those needing emergency services and fire, law enforcement, and emergency medical services in the County. Information is received in the Center via telephone lines, from field sources via radio communications, and via the nationwide law enforcement teletype network. It also maintains both phone and intercom communications with Washington County, MN to the west. The Center provides additional support to the incident or emergency upon request by the first responders or law enforcement, and coordinates responses of additional agencies when necessary. The Center maintains numerous call lists with associated policies on both PC and hardcopy, some of which are used on a daily basis.

An enhanced 911-system is in operation for all of St. Croix County. There are gaps in communication (mostly cell phone and amateur radio) due to local topography and distances,

particularly in the hills of the eastern portion of the County (e.g., Knapp Hill). This topography has also been a barrier for amateur radio operators as they attempt to communicate with one another or with the National Weather Service. The local ARES/RACES group has been investigating options to increase its ability to communicate with Dunn County to the east.

St. Croix County is one of twelve west-central Wisconsin counties participating in an interoperability communications planning grant program. The planning and coordination resulting from this effort will ensure compatibility among emergency communication systems in the region and strengthen existing mutual aid systems. There are currently no plans to pursue Project-25 (P25) compliance with the national interoperability standard for digital two-way wireless communications products and systems and there is some local skepticism whether such compliance is needed or cost-effective given associated equipment costs.

Other Weather Warning Systems

Weather sirens in the County are triggered centrally by the St. Croix County Communications Center upon notification of a severe weather warning from the Nation Weather Service and as part of a monthly test. Some of these existing sirens are aging, while many do not have battery back-up in case of a power outage. April through October. The Communications Center also can override TV and Cable TV shows with announcements as part of the emergency broadcast system, except in the City of New Richmond where an agreement to do so is not in-place with the local cable company.

Emergency Response and Operating Plans

St. Croix County has a strong, well-trained emergency response network of First Responders, Ambulance Providers, Fire Departments, and law enforcement personnel (local police, Sheriff's Department, State Patrol). The fire department districts and ambulance service areas are shown in **Figure 20** and **Figure 21** at the end of this section.

These in-the-field responders are further supported by the County Emergency Communications/9-1-1 Center, County Emergency Management, the local ARES/RACES group, government officials, and medical services (e.g., emergency rooms, hospitals, County Health Department). Certain types of disaster events may require specialized or additional assistance from other government or non-profit agencies during response and recovery (e.g., Salvation Army, Red Cross, USDA/FSA, WisDNR, County Highway Department, local public works employees). Private sector businesses and service groups may also become involved in response and recovery, such as utility providers and community groups. A Community Emergency Response Team of local citizens is also being developed in the County.

All cities and villages in the County, in addition to 4-6 towns, have emergency response or operating plans. Most of these plans are up-to-date, though it is an ongoing process of keeping these plans up-to-date

County Emergency Management has been encouraging compliance and familiarity with the National Incident Management System (NIMS) among the local governments and response agencies within the County. Twenty-two of the 32 municipalities in the County have adopted the NIMS system and over 100 officials and responders have received training.

Emergency safety plans have been developed for the St. Croix County government buildings which identify appropriate action in case of severe weather. The St. Croix County Fairgrounds also has an emergency plan, though it could be strengthened with additional attention to coordination and establishing formal shelter agreements for severe storms. It is believed that individual emergency plans do not exist for most campgrounds or mobile home parks. Additional attention may also be needed for emergency planning at some other event sites also may need additional attention to emergency planning

The County Aging Office performs an important educational role in getting information on hazard risks and personal mitigation activities out to the seniors of St. Croix County. Educational reminders are often included in the St. Croix Aging Newsletter (the Scan) or distributed at the ten County-operated senior centers located throughout the County. Special presentations to the Senior Council on such matters are also made, such as the recent presentation by the County Health Department on pandemic flue. The staff at the senior centers are also many times familiar with the seniors in their respective areas who may need special assistance in times of need and can be a valuable resource in times of an emergency. The Office also has a number of handicapped accessible vans which can also be available for transport or evacuation during such emergency, as well as a volunteer network to assist in such transport or provide assistance to the County's elderly.

Training & Incident Response Exercises

St. Croix County periodically plans and coordinates disaster and mock event exercises with municipal emergency medical personnel, local hospitals, ambulances, police, County sheriff's office, and volunteers. The County has been particularly proactive in HazMat training, with one of the strongest programs in the region. All Fire Departments in St. Croix County have been trained to the operations level. In addition, the County participates in Federally required training involving the Prairie Island Nuclear Generating Facility every six years, due to the County's location within the Ingestion Pathway Zone.

iv. Educational Mitigation Activities

St. Croix County Emergency Management has a variety of educational literature and videos available covering a wide range of hazard mitigation topics. Topics include severe weather/tornado awareness, lightning awareness, winter awareness, campground safety and fire safety. During Tornado and Severe Weather Awareness Week in April, there is extensive media coverage and safety tips, including the distribution of media packets covering tornado warning procedures.

The St. Croix County University of Wisconsin-Extension Office, Farm Services Agency, and County Land & Water Conservation Department implement various educational efforts on mitigating the impacts of hazards upon agricultural operations. These efforts include pamphlets, press releases, presentations, web site, and one-on-one discussions with farmers. Some common educational themes include how to minimize the winter kill of alfalfa and crop residue management to prevent losses in times of drought. Participation in and demand for nutrient management planning assistance and manure management planning workshops has been high. The Extension Office often works through local agri-businesses for distribution of this

information. Manure storage and spreading is well regulated and increasingly enforced by the State.

St. Croix County farmers may contact the St. Croix County University of Wisconsin-Extension Office, the St. Croix County Land & Water Conservation Department, and the Farm Services Agency Office for information and guidance related to drought. Various federal and state publications are available from these agencies on ground water movement, the hydrologic cycle, soil conservation, and irrigation methods. These agencies will also be the lead agencies in obtaining emergency food and water supplies for agricultural use.

B. CURRENT MUNICIPAL MITIGATION ACTIVITIES

Hazard mitigation activities specific to each incorporated municipality in St. Croix County were identified during meetings with the Emergency Planning Committees, municipal personnel, and local officials from each community (see **Appendix C** for key stakeholder interview list). **Appendix I** summarizes many of the key mitigation activities by community, but the table is not all inclusive.

As Appendix I shows, there are some common mitigation trends among the communities. All have building codes and zoning regulations, though the extent of site and subdivision plan review may vary. Many of the stormwater issues of the past have been or are being addressed, and substantial improvements in stormwater systems have been made in many communities, as time and budgets allow. Most, but not all of the communities have siren systems for weather warning. Existing sirens vary in age and capability, most do not have battery back-up, and the growth in the County has contributed to gaps in siren coverage in some communities.

All of the incorporated communities has emergency operating plans, with many currently updating their plans. Most were also participating in National Incident Management System (NIMS) training, though this is sometimes limited to police, fire, and EMS services providers to date. Overall, mutual aid is in good shape, though a number of communities would like to strengthen mutual aid ties for public works services and with Minnesota municipalities. All communities or their emergency services providers participate in emergency response exercises and no issues regarding these mock events was noted.

All of the communities reported good tree-trimming programs by their respective energy providers. No significant winter weather related mitigation issues were noted; some communities encourage water dripping during extreme cold in certain areas. Numerous communities need to revisit or update their floodplain ordinances based on the most recent State model, and other flood mitigation activities tend to focus improving stormwater systems or keeping streams and drainageways clear of brush and debris. Public storm shelters or shelters for mobile home park residents are available in about half of the incorporated communities, though additional public awareness or related policies may be needed in some cases.

C. STRATEGIC PARTNERSHIPS

One of the strongest examples of collaboration in the County involving both the public, private, and non-profit sectors are the St. Croix County Local Emergency Planning Committee (LEPC) and the Emergency Government & Communications Committee (EGCC). While the LEPC primarily focuses on the mandated review of hazardous materials facility plans, the EGCC meets monthly to discuss and address a wide-range of emergency management issues.

Based on past events locally and in the region, the residents of St. Croix County respond to the call for help in times of need, as reflected by the volunteer Skywarn Spotter network. Led primarily by the St. Croix County ARES/RACES group, the Skywarn network assists in the monitoring and identification of potentially severe weather events in the County. Additional volunteers for the Skywarn network would be needed for greater spotter coverage throughout the County.

The ARES (Amateur Radio Emergency Service)/RACES (Radio Amateur Civil Emergency Service) group is made up of St. Croix County residents who provide volunteer communication support using HAM radios in times of extraordinary need. During time of war, only RACES members may use amateur HAM radios. The ARES/RACES group's radios have the advantage of being operable on batteries and having a large broadcast area, though coverage challenges on the east side of the County still exist.

St. Croix County ARES/RACES works cooperatively with St. Croix County Emergency Management on emergency communications planning. Over 95% of the group is NIMS-certified. Memoranda of Understanding have also been executed between ARES/RACES and two location hospitals in an effort to coordinate emergency communications planning. It is important that ARES/RACES representatives are part of the formal St. Croix County Communications Center procedure and call list in times of emergency; some local officials may not fully understand the ARES/RACES role.

And such cooperation does not stop at municipal or county lines. Police services fall under the statewide Wisconsin mutual aid agreement, with additional support and coordination through Wisconsin Emergency Management—Emergency Police Services in times of crises. Counties in the region provide equipment and manpower support to one another in times of need, if possible.

St. Croix County Emergency Management maintains a good working relationship with many local emergency services providers, such as the St. Croix Chapter of the American Red Cross, the Salvation Army, and the United Way-St. Croix Valley. All three organizations are invited to participate during St. Croix County Emergency Management and Communications Committee meetings, which includes serving as the steering committee for this planning effort.

Another important partner in hazard mitigation and response in the County is St. Croix Energy Cooperative which provides electric power to roughly 75% of the land area of St. Croix County. The Cooperative maintains a disaster recovery plan which is tested by table-top exercises and has a very good working relationship with local emergency government officials. The Cooperative

has a proactive program to clear or widen rights-of-ways of trees which threaten overhead lines, which can be challenging and is sometimes resisted by residents. Power poles are tested on a regular rotation, and are replaced as needed. The Cooperative also provides mutual assistance in the event of a major storm, with linemen from other counties assisting in St. Croix County if needed. During the last six years, the Cooperative has spent approximately $2 million per year on new lines and substations to help meet local demands. In the past, the Cooperative has received disaster assistance funds for post-storm or flooding cleanup.

Additional support for mitigation and response is also available from the Federal and State government in times of need. For instance, during times of drought, the UW-Extension Office and USDA Farm Service Agency survey crop damage and soil status for drought declarations. These offices also survey the impacts of other hazard events on agricultural operations, provide data to the County Emergency Management Department, and are the lead agencies in obtaining emergency food and water supplies for agricultural use. These agencies may also be contacted for information and guidance regarding drought and mitigating other hazards, such as available options for crop insurance due to hail damage.

There are many additional State and Federal programs and regulations available and applicable to St. Croix County which assist in the mitigation of hazard events that are too numerous to list here, most of which are administered through the Wisconsin Department of Natural Resources, U.S. Army Corp of Engineers, U.S. Environmental Protection Agency, and the U.S. Department of Agriculture. Many of these are discussed later within **Section VI.D.** of this Plan.

FIGURE 20. St. Croix County Fire Department Districts

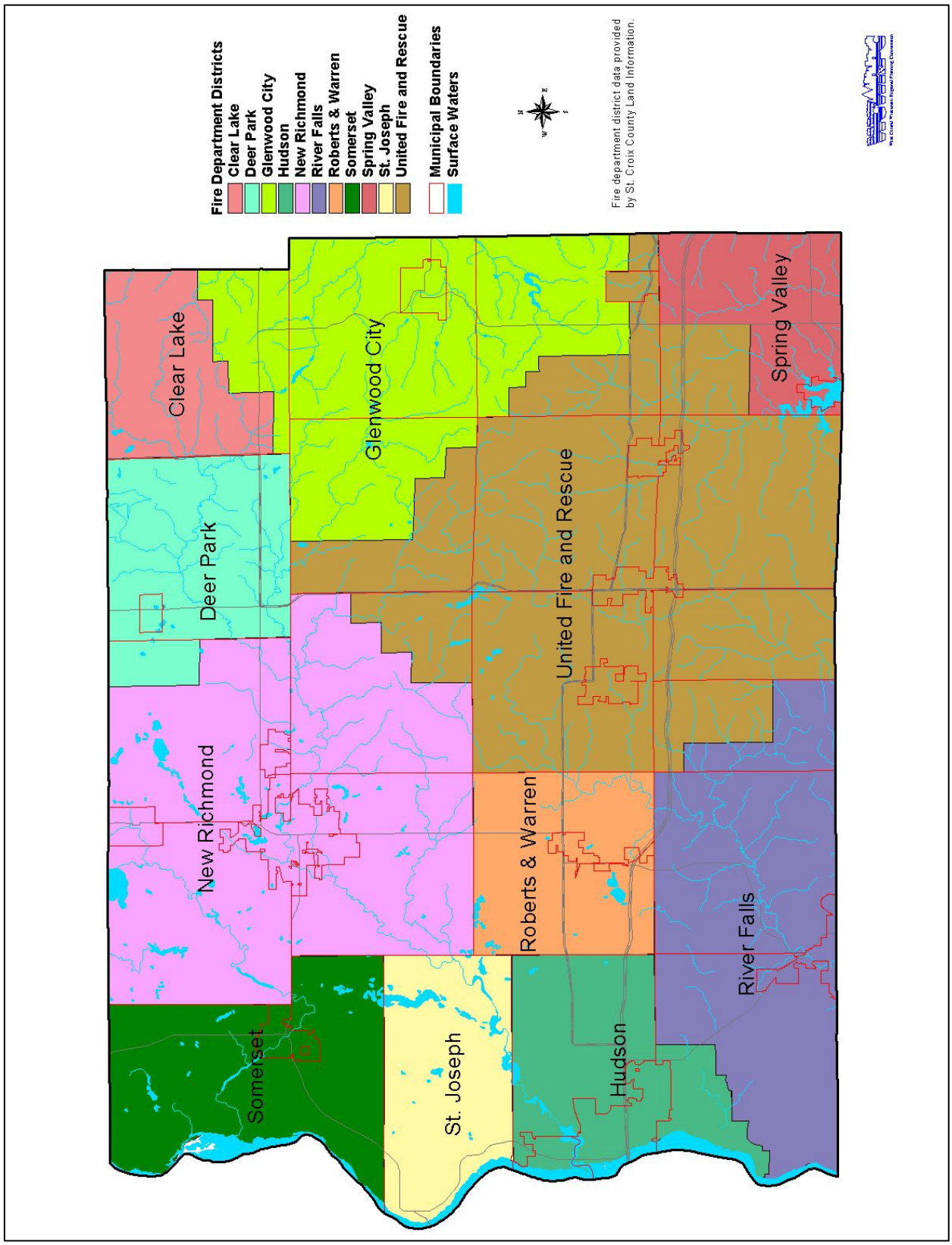
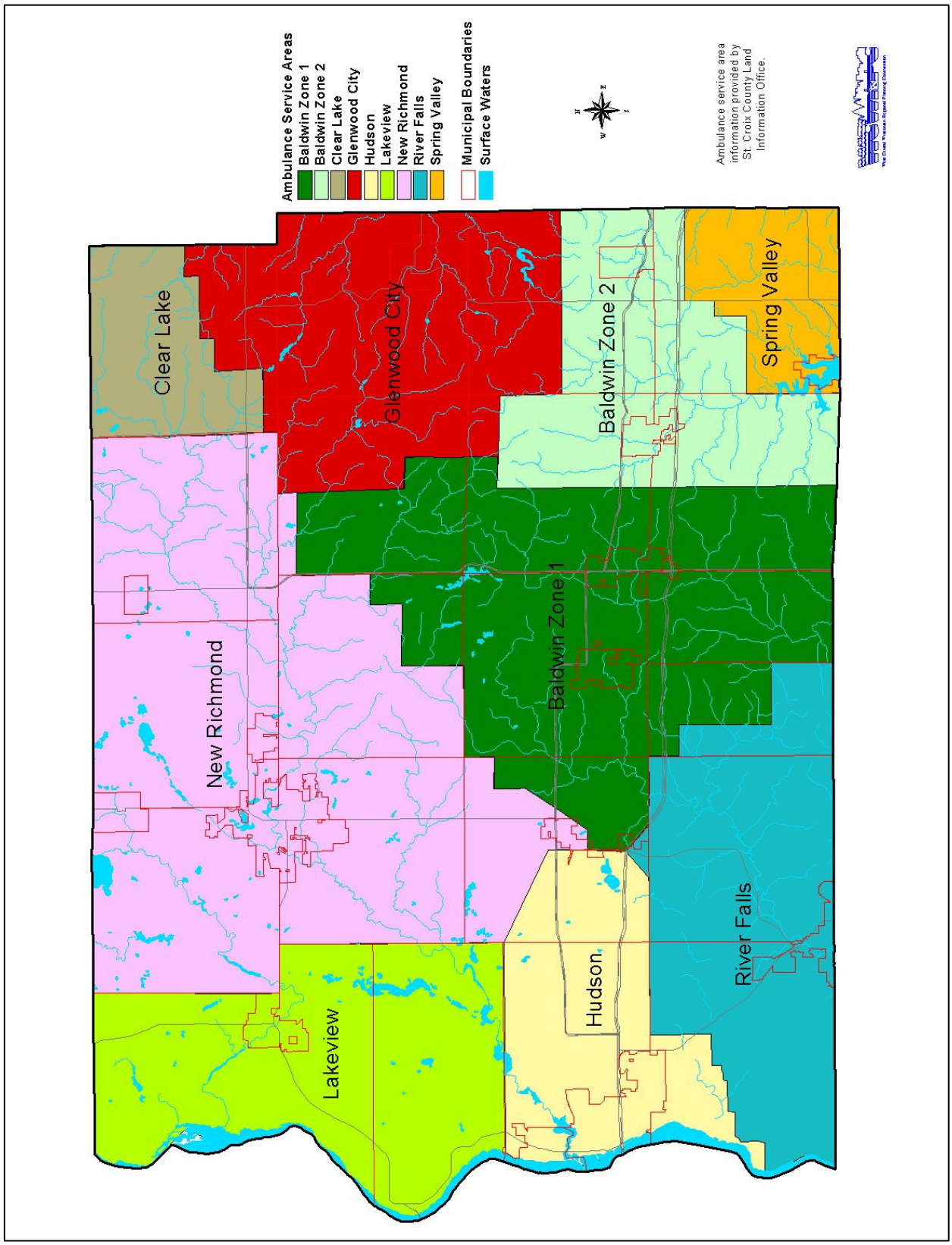


FIGURE 21. St. Croix County Ambulance Service Areas



SECTION V.

SYNOPSIS OF HAZARD ISSUES

This section summarizes the primary hazard issues identified in the previous Plan sections and **Appendix G** for which Plan strategies should be considered due to their potential impacts and the ability to further mitigate their impacts. The issues are unranked, but are numbered for convenience in referencing.

A. TORNADOES, HIGH WINDS, & THUNDERSTORM ISSUES

Risk: *Thunderstorms are very frequent (4.3 severe event reports/year), with high, straight-line winds causing the most damage. Four thunderstorm-related deaths (2 from lightning) occurred in recent years. Tornadoes have a higher vulnerability, but lower frequency (1 every 2 to 3 years). The 1899 New Richmond Tornado was the 8th deadliest in U.S. history with 117 killed. More recent significant tornado events include the 1958 Colfax Tornado which caused over $160 million in property damage, the 1982 tornado which destroyed 61 mobile homes in the Town of Star Prairie, and the 2005 tornado which damaged 38 residences in the Village of Hammond.*

Vulnerabilities: *Electric power lines and all structures are vulnerable, especially large-span buildings, mobile homes, structures with large amounts of glass, and structures with substantial numbers of people (e.g., schools, hospitals). Crops and personal property are also at risk, especially to high winds and hail. St. Croix County ranked 23rd in the State for tornado damage vulnerability (population and structural). About 36% of total lost customer hours due to power outages are the result of trees falling on power lines.*

1. Many older mobile homes are not anchored or tied down. A few mobile home parks have convenient access to storm shelters, but most do not. In 2000, 4.7% of the County's housing stock were mobile homes, slightly above the State average. 57% of the mobile homes in the County were in unincorporated areas; in most cases, these are outside the range of weather warning sirens and nearby public storm shelters are not available. Current County and most local regulations do not specifically require new mobile home parks to have a storm shelter or emergency plan, though such has been required through conditional use permitting in a few instances.

2. There are numerous developing residential areas in unincorporated towns or at the periphery of some cities and villages which are not within coverage range of current weather warning sirens. Additionally, a number of communities identified concerns with existing aging siren equipment which may need replacement in the near future or the lack of battery back-up for existing sirens.

3. The emergency plan for the St. Croix County Fairgrounds in Glenwood City could be strengthened in detail regarding specific storm shelters if a severe weather warning should occur. Some nearby business owners were overwhelmed by fairgoers during a past severe storm event. Similar plans may be lacking for some of the other event facilities (e.g., Cedar Lake Speedway) or campgrounds in the County.

B. WINTER STORMS AND EXTREME COLD ISSUES

Risk: *Relatively frequent with 3.3 severe winter storms per year. Drifting is not as significant of a problem as it has been in the past due to equipment changes, recent weather patterns, etc. True blizzards with heavy snows and sustained high winds are very rare.*

Vulnerabilities: *Primary risks are to utilities, travelers, and crops. I-94 poses the greatest travel vulnerability. For crops, winter kill of alfalfa has been the most significant problem in the recent past given lack of snow cover. Power outages during extreme cold can pose significant vulnerabilities to residents and livestock; 36% of lost customer hours due to tree damage to power lines. Ice-damming on lakes and rivers is not uncommon in some areas.*

1. Interstate 94 was the most frequently mentioned winter storm concern during the planning process. Response and sheltering plans regarding a possible closure of Interstate 94 appear to be comprehensive and up-to-date.

2. "Blow-ups" and damage to paved roadways due to freezing and thawing is a significant ongoing maintenance expense. This expense could potentially be reduced through more expensive approaches to construction, but it is at a higher initial construction cost.

3. During winter months, the social isolation of some elderly is exacerbated, especially in rural areas located farther from social services or other assistance. Assistance providers may be unaware who has the greatest or special needs, and the elder may not be aware of all available resources. Some elderly have special medical equipment which are reliant on electrical power. Transportation for pharmaceuticals and medical treatment (e.g., dialysis) also can be delayed by winter storms.

4. During approximately three to four winter seasons every 20 years, considerable winter kill occurs, affecting the alfalfa crop in particular. The crop losses have not been as serious as experienced in some adjacent counties. The severity can vary by local soil types, soil management practices, and the timing of the last cutting, with about a 50% chance of some "spotty" winter kill occurring in any given winter season.

5. Fewer than 50% of smaller livestock and dairy operations have a back-up generator in case of an extended power outage.

6. Ice-damming was identified as a potential cause of concern or contributor to flooding at four locations. One such location in the Town of Erin Prairie may have an associated National Flood Insurance Program (NFIP) claim. The Stillwater Lift Bridge, which is on

the National Register of Historic Places, is another such location which has been threatened with serious damage due to ice-damming.

C. FLOODING ISSUES

Risk: *Significant flooding occurs about once every 1.3 years in the County. Riverine flooding occurs annually in some areas, with serious riverine flooding occurring about once every 5 years on average. More frequent stormwater flooding events occur in many areas of the County, in particular in the southern towns. Some areas near lakes and ponds north of the Willow River have had past problems with flooding related to fluctuating groundwater levels, which increases surface water levels, especially at Bass Lake, Perch Lake, and in the Village of Deer Park.*

There have been 37 NFIP claims on 24 properties, with two repetitive loss properties. Stormwater and flash flooding is a concern in some developed areas, with road or culvert washouts the primary stormwater problem in the unincorporated towns. Flooding impacts on agricultural crops have been isolated and managed through insurance and good practices, though the losses can be substantial from large river flooding events (over $8 million in crop losses in 1993). Dam failure is a low risk and no major dam failures have occurred in recent years.

Vulnerabilities: *The primary flood vulnerabilities are: structures within the floodplains; road, culverts, and ditches due to stormwater flooding; and structures or improvements within a dam's shadow. Areas without sufficient natural flood storage are particularly vulnerable, and development can further contribute to localized stormwater flooding problems. Local, State, and Federal acquisition of floodplains and wetlands for parks and natural areas has significantly decreased flood vulnerabilities in the County.*

Overall, 395 structures in St. Croix County were identified as possibly being located in the 100-year floodplain (non-FIRM). Of these, 79% were residential and 12% were commercial. Only one industrial structure potentially in a floodplain was identified, that being located in Glenwood City. Shoreland development pressure continues in many areas.

1. Detailed data regarding floodplains and improvements vulnerable to flooding is relatively limited for St. Croix County. The FEMA FIRM maps are currently being updated, which should increase accuracy, but these new maps were not available for this report. No digital point data or detailed elevation data for all structures in the County is available. Due to accuracy concerns with the FIRM maps, the floodplain maps used in this plan are the same which have been used for other County planning efforts and are based on USGS elevation data.

2. Only one Extremely Hazardous Substances (EHS) planning facility appears to be located in a 100-year floodplain—the City of Hudson Wastewater Treatment Plant. The only critical facility identified as potentially being located in a floodplain is a portion of the elementary school in Baldwin, though no flooding damage was noted for the site. Portions of the New Richmond Historic District, and possibly the nearby Bernd House, may also be located in floodplain.

3. The Village of North Hudson had the largest value of assessed improvements potentially located in a floodplain with nearly $18 million in value. The City of Hudson had the next highest potential floodplain development value at about $13 million. These estimates do not include non-taxable buildings or infrastructure (e.g., Hudson wastewater treatment plant, park buildings, churches). However, the City of New Richmond had the most NFIP claims with four claims on four different properties. Notably, the worst flooding in the Hudson area occurs when flooding on the Mississippi River causes floodwaters to back-up the St. Croix River, sometimes to a height which exceeds that of the Mallalieu Dam and causes flooding along the shores of Lake Mallalieu.

4. The Cove Road area in the Town of Troy is prone to river flooding and includes the County's only two repetitive loss structures. Many of the shoreland lots in this area are in high demand, which increases the challenge of identifying acceptable mitigation strategies. This shoreland area is also wooded, with steep banks and small ravines, which offers few flood storage areas and can be prone to stormwater runoff problems.

5. Fluctuating groundwater levels at Bass and Perch Lake have contributed to a history of flooding problems in these areas resulting in 16 NFIP total claims on 8 properties, with most claimants at Bass Lake having more than one claim. Opportunities may exist to mitigate some of these flooding concerns while also contributing to local or County recreational goals. Currently, groundwater and surface water levels are down, and a pump system installed at Bass Lake may have significantly mitigated the problem at that location, but has not been truly tested to date.

6. Damage from stormwater flooding is relatively frequent with road and culvert repairs of $59,837 being 39% of the total local government assistance claims in St. Croix County for the May 2001 flood event. The southern tier of towns have a history of stormwater flooding concerns, though localized stormwater flooding events have occurred in areas throughout the County. Such flooding potential increases as development occurs, if not carefully considered and planned for. Significant riverine flooding damage is less frequent, but has historically caused significantly more damage.

7. Areas of flooding concern were identified and mapped during the planning process. Detailed engineering analysis is not available for many concerns, limiting the ability to make specific mitigation recommendations (e.g., dredging, dikes, floodproofing) at this time. The area where Trout Brook Road crosses the Willow River is one such area where a hydraulic study would be beneficial. Maintaining public lands and open space for floodwater retention continues to be an important mitigation tool in many areas, though shoreland and floodplain development pressure continue.

8. St. Croix County has nine high-hazard dams and two significant-hazard dams as rated by the WisDNR. No critical issues regarding these dams were identified during the planning process. Emergency operating plans for the dams are well-maintained and maps are available to identify structures which are located in the dam shadows. The hazard rating for the Glen Hills #3 dam may be reduced if documentation regarding zoning in the dam shadow is provided to WisDNR. The dam shadow for Glen Hills #10 along Beaver Creek extends into Dunn County and includes portions of the Village of Downing.

D. DROUGHT ISSUES

Risk: *Relatively lower concern overall, but there have been multiple drought events in recent years, with approximately one drought formally declared every ten years over the last thirty years. Near-drought conditions or agricultural droughts impacting corn and beans in some areas occurs more frequently (about once every 5-6 years on average), but a formal disaster declaration is not always made. The amount of risk and potential drought impacts vary greatly by soil type.*

Vulnerabilities: *The vulnerabilities are low-to-moderate overall, with good water quality and quantity over majority of County. Some private and irrigation wells have dried up during past droughts. However, agricultural crops have been the most substantially impacted in past droughts and livestock likely have the greatest vulnerability to extreme heat. In 2003, grain corn and soybean crop yields were down 17% and 48%, respectively, due to winter kill and drought.*

1. Drought impacts on crops can vary widely based on localized weather conditions, soil types, soil management practices, nutrient management, and crop types. Some of the sandier soils in the County can experience drought-like conditions almost annually. There has been a high demand and participation rate for nutrient management planning assistance programs among the County's farmers. However, related soil testing can be cost prohibitive for some producers.

2. Extreme heat lowers milk production and can result in the death of livestock, especially those in confined spaces (e.g., turkey barns). If brownouts or power outages occur during a period of hot weather, fans or cooling sprinklers may discontinue operation in confined livestock units, resulting in large numbers of animal deaths. There have been instances of this occurring in the region.

3. The elderly, especially those residing in under-ventilated or non-air conditioned mobile homes, is the most vulnerable population.

4. Some private wells have dried up during periods of drought in the past. Anecdotally, concerns have been expressed that high-capacity irrigation wells used in north-central portions of the County may be lowering groundwater levels and affecting some private wells, though groundwater levels have a history of significant variation throughout the area as well (e.g., Perch & Bass Lakes, Village of Deer Park).

E. PANDEMIC FLU ISSUES

Risk: *Rated by the Steering Committee as having a low-to-medium future risk or probability of occurrence, given the County's proximity to the Minneapolis-St. Paul urban area. To date, there has been no human-to-human transmission of avian flu and the Asian Bird Flu variant typically does not infect people. There have been only 267 documented cases worldwide from 2003-2006 and no cases have been documented in North or South America. However, there is no natural human immunity to the Asian Bird Flu and the potential exists for the flu to mutate into a more contagious strain.*

Vulnerabilities: *The vulnerability from Asian Bird Flu is high, with approximately 60% of the documented cases since 2003 resulting in death. Commercial vaccines are being developed, but would initially be in short demand and may not be fully effective if the strain mutates. A CDC study estimated a death rate among the U.S. Population of 0.03% to 0.09% should a pandemic outbreak occur.*

1. County and local departments and officials must continue to strive to understand respective roles as set forth in existing plans and policies. It is important not to assume that another department or agency will be available to perform a task, and to have a general idea of the resources (e.g., staff, equipment) which each department can provide.

2. As demands on time for emergency preparedness activities increase, it may become more of a challenge for programs to maintain day-to-day operations and service levels, especially given projected population increases.

3. Based on a Cornell University model, additional mass clinic locations for the distribution of pharmaceuticals are needed in the County. There is considerable planning required for each location in addition to memoranda of understanding with each site.

4. Additional certified volunteers for the distribution of pharmaceuticals at mass clinic sites are also needed. Some recruiting through the State volunteer bank is being considered, though this system has some weaknesses regarding background checks, etc.

5. Public panic could ensue should a public health emergency occur, such as a pandemic flu outbreak. Security and related enforcement could become a major issue at pharmaceutical distribution sites, area hospitals, and at other such locations.

6. The Public Health Emergency Plans do not currently have a mortuary services component.

7. The County Public Health Office has limited medical supplies which would be insufficient for a large-scale virus outbreak or mass disaster. It may take up to 48 hours before Federal assistance is available. Additional preparedness coordination between the County Public Health Office and the hospitals and other health care providers in the County is recommended to identify how resources may be maximized.

8. Special needs populations (e.g., homeless, elderly living alone) exist which may "fall through the cracks" during a public health emergency unless special outreach is undertaken.

9. While a good disaster response team volunteer base exists, there is some concern that the percentage of volunteers through Red Cross or other agencies actually responding would be significantly lower than expected should a pandemic occur.

F. HAZARDOUS MATERIALS ISSUES

Risk: *High level of risk with 8.25 reported hazardous materials incidences per year from 2000 to 2004, nearly half of which were methamphetamine related. Five Superfund sites in the CERCLIS database exist in the County, though none are on the NPL and no further action is planned at two of the sites.*

The BRRTS database has 687 records for the County between 1976 to present, of which 35% are still open. 46% of all records were started in the 1990s. Since 1976, 36% of all records were leaking underground storage tanks (LUST) or other environmental repair (ER) projects (e.g., dump sites, above ground tanks), while 46% were spills, which are typically cleaned up quickly. Since 2000, 53% of all new records were spills, while new LUST and ER records decreased to 20%.

There are two general deep-well casing areas in the County. An additional plume of contaminants in the Town of Star Prairie is also leaching from a second landfill, though no formal advisory area has been designated. The County also has 4 atrazine prohibition areas.

Vulnerabilities: *As demonstrated by the deep-well casing areas, groundwater is very vulnerable to contamination in the County. In addition, closed depressions created by karst can allow surface contaminants to quickly enter groundwater. Large fluctuations in groundwater height offers additional challenges.*

Truck traffic on Interstate 94, two rail lines, three natural gas transmission lines, and an oil pipeline running through the County are all potential sources of accidental release. The County also has 32 EHS planning facilities which handle large volumes of toxic materials. The high rate of development in the County not only increases the potential number of contamination sources, but also increases the number of private wells which can potentially be contaminated. A groundwater modeling study is underway for the Roberts area.

1. There are two general deep well casing areas in the County-- one in the Town of Star Prairie and a large area east of Hudson (Junkers-Nor Lake-Warren TCE). Special requirements apply in these areas due to groundwater contamination of private wells.

The VOC and TCE contamination associated with the deep-well casing areas are the current groundwater contamination priorities in the County. Many homes in these areas are now using whole house carbon filtration, while an expansion of municipal water to areas of Star Prairie is being considered. An additional contamination plume in the Town of Star Prairie from an older landfill is being monitored, though no additional actions are planned at this time.

Though closed in 1975, this landfill in the Town of Star Prairie has released a plume of VOC contaminants resulting in Superfund and deep-well casing designations

2. Development in unincorporated areas on private wells continues at a high growth rate. However, initial well tests do not typically include many of the types of chemicals which could be found in contaminated groundwater. Further, most homeowners do not re-test their private wells regularly after initially permitted.

3. Many landowners and developers are unaware or not fully aware how common closed depressions are in the County and how karst can further groundwater contamination. To the contrary, such depressions are sometimes used as convenient dumpsites or stormwater basins.

4. Many smaller dump sites and industries in unincorporated areas were identified by local officials as potential sources of groundwater contamination. No formal strategy regarding the clean-up or testing for the many small dump sites exists, though most are presumed to be predominately non-toxic solid waste.

5. While the non-agricultural sources of contamination are currently the primary contamination concerns, the County's land use is predominantly agricultural, which often uses or produces potential toxic or hazardous materials (e.g., pesticides, herbicide, manure). There are some manure storage facilities in the County which are no longer in use, but were never fully closed or properly abandoned.

G. NUCLEAR ACCIDENT ISSUES

Risk: *Very low risk overall for St. Croix County, though the County is within the Ingestion Pathway Zone (IPZ) for the Prairie Island Nuclear Generating Plant. The Plant is highly regulated and designed with a series of barriers and safety systems. The existing management company (NMC) has a strong safety record and reports that the facility is in excellent material condition. Three Mile Island in 1979 has been the only major accident at a commercial nuclear facility in the United States.*

Vulnerabilities: *Should an accidental release occur, direct radiation exposure or inhalation for persons in St. Croix County is very, very unlikely; such exposure would largely be limited to a 10-mile radius of the facility under most, if not all, circumstances. The primary and most likely vulnerability would be the transport of radioactively contaminated crops or dairy products from areas closer to the facility to processing facilities within the IPZ. A much less likely scenario is for the airborne contamination of soils and vegetation in St. Croix County, if weather and other conditions allow. Under such a circumstance, a general health advisory could be issued regarding food preparation practices or, in a worse case, a temporary agricultural hold may be placed on producers and/or processors of certain products.*

1. Ingestion counties are required to participate in one-day exercises once every six years, compared to the exercises held every other year for counties within a portion of the 10-mile plume exposure pathway. Further, heightened security at the facility itself has limited opportunities for emergency management personnel to visit the site. Wisconsin Emergency Management recognizes that more frequent training for ingestion counties is probably needed, but current staff resources limit the ability to increase the number of training sessions. There are so many IPZ counties in the Nation that FEMA is unable to monitor more frequently than the six-year schedule.

2. If an event should occur, even if it is a site emergency not anticipated to impact St. Croix County or other ingestion areas, misinformation and panic could ensue among the general public.

H. OTHER ISSUES AND CONCERNS

Many of the following issues address multiple hazard types or identify opportunities to potentially improve hazard response and recovery:

1. St. Croix County is experiencing tremendous growth and an influx of new residents. These new residents may not be aware of local emergency procedures, siren warning systems, available storm shelters, flood history of their property, emergency contact information, or some of the existing groundwater challenges related to new private wells. Some who may be moving from an urban to a rural area may also have unrealistic expectations regarding snow plowing or the level of available government services.

2. Federal disaster assistance for agricultural emergencies may be slow to arrive, requiring farmers to search out other funding sources, such as quick bank loans, to cover immediate costs. Multi-peril insurance is expensive and most farmers do not insure low value crops, such as alfalfa.

3. Opportunities to maximize and share resources in times of a disaster may exist, but may not be currently fully explored in advance of such a disaster. For instance, the Department of Aging has handicapped-accessible vans and a volunteer network available to provide assistance should an evacuation be needed, but such resources may not be

identified in current plans. Likewise, partnership agreements with the private sector could be formed for the sharing of other resources (e.g., food, paper products, generators) or to secure such resources at prices which are not inflated due to the event.

4. The Highway Department only has one electronic message board, which would be insufficient if highway delays or closures were required in two different directions or in multiple locations. WisDOT has not given approval for the extension of the Minnesota Department of Transportation camera monitoring system to the western portion of Interstate 94 in St. Croix County, though there is local support.

5. Wireless communication gaps occur due to distance and topography existing in some areas of the County, especially in the east, northeast, and northwest. In addition, the equipment of some communities and emergency services providers is aging and further contributes to communication problems, especially when personnel are inside buildings. One police officer noted that they sometimes can hear their radio, but cannot respond in certain locations.

6. Many communication tower sites are in rural areas for which site security can be a concern.

7. The hilly topography on the eastern edge of the County is a barrier to communications with other counties to the east, especially during poorer weather. One such barrier is the lack of direct communication between the ARES/RACES groups in St. Croix County and Dunn County. Amateur radio representatives from other counties further east have also expressed a need to increase communication capability, and an effort to establish a statewide repeater system is underway. Similarly, as technology changes and agencies become more diverse, the importance of interoperability among communities, counties, and other emergency service providers increases.

8. Further coordination between County offices and officials with the local ARES/RACES group may be beneficial to further define and clarify ARES/RACES roles in a disaster situation.

9. Additional practical, in-the-field exercises involving the coordination of emergency communications would be beneficial. Such mock event exercises would include communication among the field, dispatch, other agencies, and ARES/RACES, therefore testing the entire network. This would also allow hands-on training as equipment and frequencies change to ensure good interoperability, while helping to identify any gaps in existing call lists.

10. While the Skywarn Network has a solid volunteer base through the ARES/RACES group, there are numerous areas in the County which are uncovered which could benefit from more local government or responder involvement.

11. Mutual aid with Minnesota and Minnesota communities could be strengthened and is often hampered by a lack of State-to-State mutual aid agreements. For instance, the

bomb squad from the Minneapolis area could be available within 30-45 minutes, rather than waiting 2-3 hours for such a squad to arrive from Madison. Similarly, there are no inventories exchanged of available resources in times of emergency and no formal agreements in place regarding the sharing of these resources.

12. Many town board chairman and other town officials are not fully aware of their roles and responsibilities in times of emergency or when a disaster occurs. Lessons learned from the 1994 "Foster Tornado" in rural Eau Claire County included making sure town officials had different maps of their community readily available should a disaster occur and involving the town chairmen in operations and recovery planning meetings to ensure they are kept informed. Additional radios may also be needed, as well as adequate emergency lighting on generators.

13. Also from the "Foster Tornado" experience, one part of emergency planning sometimes not considered in advance is the outpouring of citizen support in clean-up and recovery which can be near overwhelming. This is typically handled by private groups and non-profit agencies, but some general coordination is still needed. In the Foster case, home-cooked food donations from church groups and private systems could not be used by the Red Cross, while local citizens spent many hours sorting through a truck load of donated clothes, some of which was dirty and unusable. However, involving local residents can also be very valuable and play an important role in recovery. After receiving tetanus shots, local school children assisted in the clean-up of fields so harvest could move forward, allowing them the opportunity to contribute.

14. The St. Croix Electric Cooperative identified a number of hazard-related challenges: (a) keeping up with high growth has made it financially difficult to replace older (1950s) line and equipment in some areas which is more vulnerable to lightning strikes and temperature extremes; (b) some wooded areas prone to outages have rocky terrain (e.g., Town of Troy along St. Croix River) for which it is very costly to bury lines; and, (c) an additional substation and line is needed in the North Hudson area so the power supply can be looped, thus increasing dependability.

15. Many of the recovery shelters agreements in the County are not up-to-date and most of the shelters do not have generators. Relationships with agencies that provide special-needs shelters for the homeless, nursing homes, group homes, medical conditions, etc, are also needed, along with contingency plans for alternative sites and caregivers should the primary sites not be available.

16. Continued training of volunteers at shelters, on disaster teams, or other emergency response functions is needed, including involvement in mock event exercises. Some of these individuals may be available to take a stronger leadership role and additional responsibilities, if given the support, training and guidance.

I. GENERAL MULTI-JURISDICTIONAL ISSUES

Hazard issues and risks unique to incorporated communities can be found by reviewing the vulnerabilities and mitigation activities identified in the previous sections and in Appendices G and I. However, there were some common trends identified where more than one community noted the following needs or issues:

-- a few communities require more effort to update Emergency Operating Plans, though most communities have been very active on this and NIMS training

-- many communities lack community storm shelters or shelter agreements for approaching storms, though some communities felt that such shelters were not needed

-- significant amounts of new slab-on-grade construction, especially in the western half of the County

-- local regulations typically do not have anchoring, emergency planning, or storm shelter requirements for mobile homes or mobile home parks

-- power losses due to wind or ice storms taking down trees and power lines

-- mutual aid is good overall, though some communities are working to develop mutual aid agreements which cover public works personnel; insurance concerns and employee union contracts have necessitated formal agreements, rather than the less informal mutual aid system used in the past

-- some concerns identified with long, dead-end roads, cul-de-sacs, or other road design concerns (e.g., undersized width or turnaround) which can be a challenge for emergency vehicles or if evacuation is needed

-- gaps in wireless communication systems

-- aging sirens or existing sirens lack battery back-ups; new sirens needed at the periphery of some communities for improved coverage

-- only 3 incorporated municipalities had NFIP claims in St. Croix County; stormwater is generally a more significant concern for some communities, especially as more development occurs

-- railroad lines transverse most communities and are potential hazardous materials concerns if derailments occur

SECTION VI.

MITIGATION GOALS AND STRATEGIES

St. Croix County will continue to proactively protect the health, safety, and welfare of the community by mitigating the negative human, economic, and environmental impacts of hazard events. This vision will be accomplished through planning, evaluation, communicating with stakeholders, and maintaining a strong, reliable infrastructure. This Plan reflects the County's past, current, and ongoing commitment to hazard mitigation.

A. MITIGATION GOALS

The mitigation goals are intended to provide direction to achieve the desired outcome and are to be used as guidelines by which mitigation activities are identified and impact is evaluated. The goals provide St. Croix County further direction for determining the future and reflect the needs of the County as identified through the assessment of hazard conditions and community profile.

During the key-informant interview process and Steering Committee meetings, some common themes were frequently mentioned which provided important direction for goal-setting and the analysis of potential strategies:

- *Promote self-reliance and responsibility among community members and land owners to address hazard issues. Make the public aware of the hazards they face and how they can protect their interests. Local government action should not supplant individual responsibility.*
- *Use a cost-benefits approach to potential strategies. Priorities must be established based on potential impacts, probability of occurrence, benefits of solutions, and related (implementation and maintenance) costs. Resources may not be available to resolve isolated or sporadic events. Many low priority projects may only be feasible for implementation with grant assistance.*
- *Related to the cost-benefits approach, substantial changes or amendments to local regulations should have sufficient justification and, when possible, be based on empirical evidence. Allow statistical analysis, scientific studies, and engineering assessment guide policy decisions.*
- *Coordinate and compliment hazard mitigation planning efforts with other planning efforts in the County when possible. Promote coordination between communities and agencies to maximize resources.*
- *Implementation will be contingent on available resources and must be considered in the context of other local priorities or projects at that time. In many cases, staff resources may limit the ability to implement all Plan recommendations. The Plan goals and strategies express local interest and intent, though actual implementation will in many cases hinge on the availability of resources.*

- *The high rate of population growth and development is increasing hazard risks, vulnerabilities, and the related emergency planning, mitigation, and response costs. Communities and agencies are being asked to do more, often with funding which does not keep up with the rate of growth or inflation.*

With consideration of these guiding themes, the Steering Committee agreed upon the following *St. Croix County All Hazards Mitigation Plan* goals:

Goal One: Physical Development and Infrastructure Goal

Build and maintain a strong, physical infrastructure and limit damage to homes, structures, and other improvements from the impacts of hazard events when cost-effective opportunities exist.

Goal Two: Planning and Policy Goal

Use empirical analysis to assess hazard vulnerabilities and to develop appropriate plans and policies which are complimentary whenever possible and implemented and enforced in an effective and uniform manner

Goal Three: Communication Goal

Provide an effective hazard warning system and maximize available resources for emergency planning, response, and recovery, by strengthening intergovernmental coordination between communities, agencies, and other service providers.

Goal Four: Education Goal

The citizenry, private sector, and local governments of St. Croix County will be aware of hazard risk and vulnerabilities, along with the appropriate strategies for implementation in their homes, businesses, and communities to mitigate the impacts of a disaster or hazard event.

B. EVALUATION OF ALTERNATIVE MITIGATION STRATEGIES

A comprehensive range of alternatives was considered when developing strategies to meet the Plan's vision and goals. A description of many of these alternative mitigation strategies is included in the Mitigation Toolbox in **Appendix J**.

From the Mitigation Toolbox, potential mitigation strategies to address the hazard issues identified previously in **Section V** were identified during the key stakeholder interview process and Steering Committee meetings. Each of these strategies was further examined in **Appendix K** for community acceptance, administrative feasibility, costs, benefits, and other considerations. This analysis incorporates a cost-benefits approach when possible to help identify any potential barriers or challenges to implementation. The cost-benefits analysis was also used during the development of the Mitigation Implementation Plan in **Section VI.D** to prioritize the strategies.

The Steering Committee reviewed the potential strategies and identified through consensus needed changes and the recommended strategies for inclusion within the Plan, as well as additional recommendations which may not have been part of the initial feasibility analysis as reflected in Appendix K. In some cases, multiple alternative strategies were combined to form a single, final plan recommendation.

The alternative strategies were largely reviewed in the context of this Plan based on their ability to mitigate the impacts of hazard events and in consideration of existing resources and circumstances**.** A decision to not recommend a potential strategy does not eliminate the strategy's potential for future implementation in St. Croix County. In fact, some potential strategies not recommended within the feasibility analysis or given a low priority in the implementation plan may be addressed through other planning efforts in the County or given a higher priority by a specific community due to other potential benefits (e.g., environmental, safety, security).

C. RECOMMENDED MITIGATION STRATEGIES (ACTION PLAN)

Each of the following mitigation strategies is organized by the Plan goal to which it corresponds. These strategies are specific mitigation actions and projects selected based on their feasibility to assist St. Croix County in attaining each strategy's corresponding goal. In some planning efforts, such strategies are synonymous with objectives or implementation steps. Some strategies may also have a strong emergency preparedness emphasis, but have been included for their importance in helping to mitigate the negative impacts of hazards when they do occur.

Physical Infrastructure Mitigation Goal & Strategies

Build and maintain a strong, physical infrastructure and limit damage to homes, structures, and other improvements from the impacts of hazard events when cost-effective opportunities exist.

1. Pursue federal funding for a storm shelter/safe room initiative which subsidizes the installation of safe rooms or shelters for mobile homes and mobile home parks.

2. Pursue the installation of warning sirens in areas of high residential density or growth which are currently outside siren coverage areas (e.g., portions of Towns of Troy, Hudson, Somerset, Star Prairie, peripheries of many incorporated areas). This may include campgrounds and mobile home parks in unincorporated areas. Numerous communities also expressed interest in replacing aging siren equipment or providing battery back-up.

3. Pursue grant funding for a manufactured/mobile home anchoring project which encourages the anchoring of older mobile homes.

4. Continue to study and address stormwater flooding, road washout problems, and ice-damming as identified in the vulnerability assessment. (numerous projects)

5. Work with St. Croix Energy Cooperative to pursue hazard mitigation funding to replace aging power lines and an additional substation for the North Hudson area to further mitigate the potential of power outages and increase the dependability of power service.

6. Pursue hazard mitigation funding to acquire or relocate structures and properties most at risk of major flood damage when the opportunity arises and/or following a flood event in which significant damage occurs.

Planning- & Policy-Related Mitigation Goal & Strategies

Use empirical analysis to assess hazard vulnerabilities and to develop appropriate plans and policies which are complimentary whenever possible and implemented and enforced in an effective and uniform manner.

7. Continue to enforce County floodplain regulations and related land-use ordinances to discourage future floodplain development, the storage of hazardous materials in floodplains, require dry land access for all new structures, limit development in dam shadows, and maintain natural flood storage areas.

8. Adopt County mobile home regulations which require new mobile home parks to identify per formal agreement a storm shelter or construct a new storm shelter for residents. Require new and encourage existing mobile home parks in unincorporated areas to have emergency plans which will be on-file with the County.

9. Continue to make emergency planning for pandemic flu a high priority for the County, such as identifying additional mass clinic locations and building a group of strong, certified, volunteers for distribution of pharmaceuticals. Utilize an all-hazards approach which maximizes resources (e.g., medical supplies, transportation) and addresses mortuary services as part of public health emergency plans regardless of hazard type.

10. Continue pandemic flu planning and educational efforts related to social distancing and quarantine which will be critical to containment. Related security and enforcement issues shall be considered as part of mass clinic plans and related planning efforts.

11. Continue annual review of the emergency action plans for the County dams and ensure that the contact and telephone calling lists are up-to-date. Whenever updates, send copies of the emergency action plan to the local municipalities to help keep residents informed. Copies of the Glen Hills Dam plans should be sent to Dunn County Emergency Management and the Village of Downing.

12. Inventory the warning siren coverage areas of the County, along with the age and capabilities of the equipment (e.g., battery back-up). Use G.I.S. to compare with land uses and population density to recommend additional coverage areas.

13. Develop and maintain a resource directory for use in times of disaster by coordinating agencies (e.g., Department of Aging has transportation services). Such a directory could

be expanded to include standard requirements for the sharing of equipment and billing rates.

14. Provide support to the emergency planning efforts for the St. Croix County Fairgrounds to address the need for storm shelter(s), securing agreements with nearby property owners if needed. Similar planning efforts to protect non-resident visitors should be pursued for other facilities (e.g., Cedar Lake Speedway).

15. Conduct an inventory of the location, condition, anchoring, and emergency plans of mobile home parks in the County, including availability of shelters and warning systems. If a need is evident, pursue additional mitigation strategies (e.g., assistance program for anchoring; relocation from floodplains, emergency plans, sirens, shelter agreements).

16. Continue to encourage coordination between Wisconsin and Minnesota so that related health emergency policies and procedures are consistent and compatible, such as the manner in which pharmaceuticals will be distributed if a pandemic flu outbreak should occur.

17. Develop partnerships among health agencies, local jurisdictions, non-profits, and other service providers to identify special needs populations who may be in need of special assistance or outreach in times of emergency. Make special effort to identify elderly in rural areas who may have less access to services or those in need of special medical assistances (e.g., dialysis).

18. In the future, the Land & Water Conservation Department will work with UW-Extension and the Center for Watershed Science and Education to update the May 2006 "*An Introduction to Groundwater in St. Croix County*" to include re-testing of the over 2,000 residential wells, as is possible, for comparison purposes.

19. Work with UW-Extension and local electric providers to develop a portable back-up power generator loan program for agricultural operations in case of prolonged electrical failure.

20. As part of the next hazard mitigation plan update, pursue financial assistance to identify structural elevations, structure characteristics, and corresponding regional flood elevations for all structures in the 100-year floodplain and in dam shadows.

21. Continue building a CERT (Community Emergency Response Team) Unit by submitting grant requests to OJA and recruiting personnel.

Communication-Related Mitigation Goal & Strategies

Provide an effective hazard warning system and maximize available resources for emergency planning, response, and recovery, by strengthening intergovernmental coordination between communities, agencies, and other service providers.

22. Continue to involve the St. Croix County ARES/RACES group in emergency communication planning and mock event exercises in the County; further define their role during a disaster as part of established EOP procedures.

23. Increase preparedness of campgrounds and resorts to severe weather by: (a) promoting use of all hazards (weather) radios; (b) requiring the provision of emergency information to patrons; and (c) requiring new campgrounds or resorts to identify a severe weather shelter.

24. Maintain the frequency of the practical, in-the-field exercises involving the coordination of communication between dispatch, field units, and other service providers.

25. Continue to work with regional ARES/RACES groups and other counties to strengthen amateur radio communications in eastern St. Croix County, with Dunn County, and with communities to the east. This may be part of the statewide repeater network (WeComm, LTD) being development primarily for ARES/RACES groups.

26. Continue to participate in the multi-county interoperability communication planning effort.

27. Strongly encourage the State of Wisconsin to work with St. Croix County and local communities to allow for mutual aid and other agreements with the State of Minnesota and its communities if emergency services can be improved, such as decreased response times.

28. Work with Red Cross to address the existing recovery shelter weaknesses: some shelter agreements are out-of-date, most shelters do not have generators, and relationship between agencies which provide special needs shelters could be strengthened so contingency shelter sites and caregivers are identified.

29. Continue to work toward Countywide compliance with the National Incident Management System for emergency service providers and municipalities in the County. Explore options to integrate NIMS into local emergency operating planning efforts if feasible.

Education-Related Mitigation Goals & Strategies

The citizenry, private sector, and local governments of St. Croix County will be aware of hazard risk and vulnerabilities, along with the appropriate strategies for implementation in their homes, businesses, and communities to mitigate the impacts of a disaster or hazard event.

30. During mock or tabletop exercises, increase emphasis on different agency roles, resources, and responsibilities during times of disaster, including the private and non-profit sectors (e.g., electric providers, Red Cross). Periodic coordination meetings should be include voluntary organizations active in disaster (VOADs) from the area to continue to strengthen these relationships. Anticipate the roles and expectations of local community groups (e.g., church groups, schools) might also have in recovery.

31. Once every two years, County Emergency Management should give a special presentation to the Towns Association on the responsibilities of town officials in times of disaster, along with related policies and procedures. Presentation copies should also be mailed to each town clerk.

32. More fully develop the County's emergency management webpage with valuable links and information for local communities, residents, farmers, and service providers, with special attention given to information for new residents.

33. Continue with the County Land Conservation Department's pest and nutrient management workshops which have likely helped mitigate potential winter kill, agricultural-related stormwater flooding concerns, and help protect water quality.

34. Continue public educational efforts regarding the County's warning siren system and promote the benefits of all hazards (weather) radios for private citizens, campgrounds, resorts, and businesses through local media and community events.

35. Pursue grant funding for a safe room initiative to encourage the installation of safe rooms as part of slab-on-grade residential construction. The project will primarily be an educational initiative through local media and local developers, though small subsidies or rewards (e.g., weather radios, sponsor gifts) might be included if funding and support are available.

36. Work with local communities to increase public knowledge of available "Clean Sweep" programs and other methods of disposing of potentially hazardous wastes. Encourage additional State support to increase availability of these program when possible.

37. Continue to increase public knowledge of groundwater contamination concern when opportunities exist, including for builders, realtors, and local government officials. Special attention should be given to closed depressions.

Multi-Jurisdictional Mitigation Strategies

The following strategies primarily apply to the incorporated municipalities of St. Croix County.

38. MUNICIPALITIES (various or all) – Consider NIMS and evacuation planning as part of their local emergency operating planning efforts. Numerous incorporated communities need to review and update their local emergency operating plans. Community emergency plans should also address the offsite back-up or storage of official data and records.

39. MUNICIPALITIES (various or all) -- If deemed feasible and desirable by the community, amend local ordinances to require storm shelters or safe rooms for slab-on-grade residential construction, if another storm shelter option is not readily available.

40. MUNICIPALITIES (various or all) -- Review, and amend if deemed necessary, local ordinances to require new mobile home parks to provide storm shelters for residents and maintain emergency plans for the parks which are provided to the municipality. Enforce such conditions.

41. MUNICIPALITIES (all) -- Maintain communication between the communities and the County to take advantage of joint-bidding or coordinate grant efforts when opportunities arise.

42. MUNICIPALITIES (all) -- Continue to actively participate in mock event and tabletop disaster exercises and training sessions, realizing that while hazard risks and vulnerabilities are increasing, federal or state funding support for such exercises may be decreasing.

43. MUNICIPALITIES (various or all) -- During land-use, stormwater management, and comprehensive planning efforts, discourage development in 100-year floodplains and floodprone areas, encourage the preservation of natural flood storage areas, and maintain natural buffers around known kettles and closed depressions.

44. MUNICIPALITIES (various or all) -- Review or consider adoption of subdivision and/or road standards to address, as deemed necessary, adequate access for emergency vehicles, minimize stormwater flooding potential, adequate setbacks from high hazard infrastructures (e.g., railroads, I-94, natural gas transmission lines), and the burying of power lines for major subdivisions in wooded areas.

45. MUNICIPALITIES (various) -- In communities experiencing significant development, create and adopt official maps which are integrated into comprehensive plans to preserve adequate street rights-of-ways for emergency vehicles while preventing or minimizing long dead-end roads.

46. MUNICIPALITIES (all) -- Establish formal agreements between jurisdictions for the provision of public works mutual aid in times of emergency and disaster.

47. MUNICIPALITIES (various) -- As needed, identify storm shelters for residents or mobile home parks, execute formal agreements for shelter use, and use local media and park owners to help educate residents on availability. Needs or issues vary significantly by community.

48. MUNICIPALITIES (various) -- Consider participation in the FEMA Community Rating System program for floodplain management which encourage flood mitigation activities while potentially reducing flood insurance premium rates. In particular, the communities of N. Hudson, Hudson, New Richmond, and Baldwin should consider participation due to existing potential 100-year floodplain development or history of NFIP claims.

49. MUNICIPALITIES (various) -- A follow-up field training drill should be scheduled with those communities (New Richmond, Hudson, Glenwood City to date) who have conducted a water contamination tabletop exercise. Key "water personnel" from these communities should have water sample collection training.

50. RIVER FALLS, SPRING VALLEY -- Continue with implementation of those applicable mitigation strategies identified in the *Pierce County All Hazards Mitigation Plan*.

51. BALDWIN, NEW RICHMOND, RIVER FALLS, WILSON, WOODVILLE -- Explore the feasibility of new or additional warning sirens or updated siren systems. If funding becomes available, some additional communities may consider battery back-up for existing sirens.

52. BALDWIN, HAMMOND, SOMERSET, STAR PRAIRIE, WILSON -- Update floodplain ordinances based on new State model, as needed. Once an update and new FIRM maps are adopted, the Village of Star Prairie should contact the State Floodplain Coordinator to ensure that current NFIP sanction status is addressed.

53. BALDWIN, HUDSON, WILSON -- If funding or opportunities arise (e.g., GSA), acquire a back-up power generator for utilities should electrical power fail due to a hazard event.

54. BALDWIN, WILSON -- Consider establishing (Wilson) or continue with (Baldwin) tree or urban forestry programs to help protect trees of special value to the community from the effects of storms.

55. BALDWIN -- Subject to further analysis, integrate a new vehicular bridge on 12th Avenue as an alternative crossing of the creek into local plans, transportation improvement plans, and capital budgets.

56. BALDWIN -- As part of future stormwater management plan updates, identify options to address the significant stormwater ponding in the 8th Avenue and Lorkorst Street area.

57. DEER PARK -- As part of future comprehensive planning, map flood hazard areas (as opposed to floodplains) in the Village to discourage development in those areas while preserving needed flood storage.

58. DEER PARK -- Replace septic lines near the ballpark to prevent future infiltration of floodwaters into the sewer system.

59. DEER PARK -- If flooding problems for the Village continue or worsen, conduct an engineering study to investigate the feasibility of diverting drainage on the east side of the Village away from the Village and towards the south to the Willow River using older, natural drainageways when possible.

60. HUDSON -- Continue with implementation of the City's stormwater management plan, including for those areas identified in the flood assessment and helping to prevent uncontrolled stormwater runoff into older neighborhoods.

61. GLENWOOD CITY -- Address any safety concerns along public portion of Glen Meadows Lane as capital budgets allow.

62. NEW RICHMOND -- Work with the Town of Stanton, County Health Department, and mobile home park owner/residents to address the septic system concerns within the mobile home park to the east of the City.

63. NEW RICHMOND -- If feasible, integrate stormwater management components into the design of the new recreational park on the north side of the City to help alleviate the flooding problems of the Armory area.

64. NEW RICHMOND AREA -- Communities and school districts in the Town of Star Prairie area should continue to work cooperatively to address the groundwater contamination issues related to the jointly owned landfill, including the efforts of the unincorporated entities to identify and secure grant funds. A boundary agreement between the Town and City is recommended as part these discussions.

65. NEW RICHMOND, TOWN OF STAR PRAIRIE -- Continue to increase attention on the contamination plume from the older landfill in the Town of Star Prairie, and encourage a determination of whether further action is warranted, such as the establishment of an additional deep-well casing area.

66. NORTH HUDSON -- As funding allows, resolve washouts and serious bank erosion at Ferry Landing Park and Brown Beach areas along the St. Croix River.

67. NORTH HUDSON -- Work with the WisDOT to address past stormwater problems as part of planned Highway 35 improvements.

68. NORTH HUDSON -- Pursue project support for a floodplain and engineering analysis of the Riverside Drive area to better identify flooding vulnerabilities to homes and infrastructure and analyze mitigation options.

69. ROBERTS -- With updates of the Village Emergency Action Plan, review, and amend if deemed necessary, the policies and procedures related to the availability of the school as a public storm shelter.

70. SOMERSET -- Continue efforts to acquire an easement or other property rights for use of the swale on the south side of the Village for stormwater drainage in accordance with approved stormwater management plans.

71. STAR PRAIRIE -- In the future, construct an additional municipal well on the west side of the Village.

72. WOODVILLE -- Continue implementation of the Village stormwater management plan with potential improvements at the River Street Bridge over Eau Galle Creek in the future as funding allows.

73. WOODVILLE -- Work with the County Emergency Communication Office to analyze options to address the radio coverage challenges with the community.

74. WOODVILLE -- Explore grant opportunities for the integration of a public storm shelter as part of the proposed new fire hall. If grant funding is not available, establish procedures for use of the Village Hall as a storm shelter.

D. MITIGATION IMPLEMENTATION PLAN

The mitigation implementation plan is included in **Appendix L**. Based on the costs-benefits analysis, each strategy was assigned a relative priority and timeline for implementation, as well as the agency or program with the lead responsibility for initiating the recommended action.

Potential State and Federal grant programs are referenced in the implementation plan and many are included in a table within **Appendix M**. Additional information on Federal grants can be found at www.cfda.gov. Substantial infrastructure improvements may also be funded locally through the establishment of a stormwater utility district or ordinance fee system, tax incremental financing (TIF), general obligation bonds, and developer contributions or exactions.

Additional sources of financial support are also often available following a disaster event, such as U.S. Small Business Administration (SBA) loans for the repair or replacement of property. The U.S. Department of Agriculture, through its local Farm Service Agencies, provide additional disaster assistance for crop losses and livestock emergency through programs such as the Disaster Reserve Assistance Program (CFDA #10.452) and Noninsured Crop Disaster Assistance (CFDA #10.451). Grant funding for additional emergency measures, such as the rehabilitation of flood control works, is available through the U.S. Army Corps of Engineers. In the event of an impending or recent disaster, municipalities and the County Emergency Management

Coordinator are encouraged to contact Wisconsin Emergency Management and the agencies identified in Appendix M for potential assistance, since available resources and related requirements frequently change and this list is not all inclusive.

As noted in the discussion of the costs-benefits analysis, the majority of the strategies will utilize existing program budgets for implementation. However, like many municipalities, St. Croix County is facing fiscal challenges; and resources are limited to serve a fast-growing population. The recommended strategies will be implemented as resources (e.g., funding, staffing, time) allow. The prioritization of the strategies offers guidance to departments and communities in the implementation of this Plan based on available resources and changing conditions. And as the implementation plan reflects, with such challenges also come opportunities to form or strengthen strategic partnerships to share and leverage existing resources.

With the exception of this planning effort funded with FEMA Pre-Disaster Mitigation (PDM) Grant dollars and $10,100 received by the Village of Deer Park in 2003 for the acquisition of a residential structure, St. Croix County and its municipalities have not received any additional FEMA hazard mitigation, pre-disaster mitigation, and flood mitigation grant funding in the past. Other federal grant support has been received for specific projects, such as a variety of highway improvements and the interoperability communication grant project, but these were not mitigation projects funded through FEMA.

Past State Hazard Mitigation Plans do not include any potential future mitigation projects for St. Croix County. However, numerous projects identified in Appendix L of this Plan may qualify for grant funding. And more insight into potential projects for incorporated communities were identified previously in the flooding vulnerability assessment, the *Unique Jurisdictional Risks or Vulnerabilities Table,* and the accompanying maps in Appendix G.

Communities requiring funding assistance to solve past flooding hazards or mitigate substantial vulnerabilities are encouraged to work with County Emergency Management and the State of Wisconsin Emergency Management Office to add their projects to the State's potential project list. Just be aware that these mitigation funds are limited, competitive, and prioritized on a cost-benefits basis, so the issue must be documented and the needs related to large projects must be substantial.

SECTION VII.

PLAN ADOPTION & MAINTENANCE

A. PLAN COORDINATION

The mitigation implementation plan in Appendix L also links the mitigation strategies to any related plans or policies. Most notable potential plan or policy impacts include:

- Many of the strategies require amendment of local capital improvements plans and other budget documents. Most notably are the large infrastructure projects which are more capital-intensive (Strategies 4, 41, 55, 58, 61, 71).
- Additional large capital improvements projects can include stormwater systems. The following strategies are related to local stormwater management planning: 43, 56, 60, 63, 67, 70, 72.
- Numerous proposed strategies require analysis, modification, or enforcement of existing County or local land-use plans or codes (e.g., comprehensive planning, subdivision ordinance, zoning ordinance, floodplain ordinance, building codes, official mapping): 7, 8, 39, 40, 43, 44, 45, 48, 52, 57.
- The following strategies are related to existing emergency operating or response plans: 9-14, 16, 17, 21,25, 27-30, 38, 46,47, 69.
- County Emergency Management has been encouraging local communities to incorporate warning siren coverage area maps into their emergency operation plans. A county-wide analysis and map of these coverage areas could also be incorporated into the County's emergency operating plan. Further, a cooperative, multi-jurisdictional grant effort could be pursued to fill gaps in coverage areas and replace aging equipment (Strategies 2, 12, 51).

Some recommended strategies may also qualify for FEMA mitigation grant funding through the Hazard Mitigation Grant Program, Pre Disaster Mitigation Grant Program, or the Flood Mitigation Grant Program, and may be included in future updates of the *State of Wisconsin Hazard Mitigation Plan*. These strategies include:

#1 - Storm shelter/safe room initiative for mobile homes

#3 - Mobile home anchoring project (could be combined with #1)

#5 - Replacement of aging power lines (partner w/ St. Croix Energy Cooperative)

#6 - Acquisition and/or floodproofing of floodprone properties

#20 - Future hazard mitigation plan updates

#35 - Storm shelter/safe room educational initiative (could be combined with #1)

#59 - Flood diversion project in Deer Park

#66 - Bank washouts and erosion along St. Croix River in North Hudson

#68 - Riverside Drive area analysis and flood mitigation activities in N. Hudson

#74 - Integrate a public storm shelter into new Fire Hall plans in Woodville

Appendix M includes a list of additional potential hazard mitigation grant programs to help fund the strategy recommendations.

B. PLAN MAINTENANCE

i. Annual Plan Reviews

The St. Croix County All Hazards Mitigation Plan will be evaluated on an annual basis in order to determine if the Plan has become obsolete, if conditions have changed within the County, or if new technologies/approaches to hazard mitigation have become available. This will be a formal process to monitor the implementation of the mitigation activities and progress toward the Plan goals.

St. Croix County, through its Emergency Management Department, will complete periodic reviews. A review will take place within one year of the completion and adoption of the Plan by the County Board and annually thereafter within the first quarter of each year. The review will generally consider the following:

1. Review of development trends and any changes in existing conditions.
2. Review of any new mandates, rules, etc, as well as any input from Wisconsin Emergency Management (WEM) and the Department of Homeland Security--Federal Emergency Management Agency (FEMA) regarding Plan implementation.
3. Review of Mitigation Plan goals and strategies, such as completed activities and their effectiveness, and activities yet to be completed and funding sources
4. Potential new strategies or activities.
5. Public input received on the Plan and activities.

Findings of the annual reviews will be presented to the County Emergency Government and Communications Committee and will be subject to the Wisconsin Open Meeting Law and properly noticed to allow for public involvement and comment. The Emergency Management Coordinator will have primary responsibility for establishing meeting dates, distributing related materials, and facilitating the meetings.

After completion of each annual review, the County Emergency Government and Communications Committee will recommend any revisions or amendments to the Plan as necessary. The revisions will be forwarded to the County Board for their consideration and action. New or additional mitigation strategies may not require plan amendment, though should be incorporated within the Plan if grant funding is being pursued.

ii. Special Post-Disaster Reviews (Lessons Learned Best Practice)

Within three to six months following a significant hazard event as determined by the Emergency Management Coordinator, a special post-disaster review will occur. Information regarding the recent disaster will be collected by the Emergency Management Coordinator from local law enforcement personnel, fire department personnel, St. Croix County disaster response personnel, DNR, WEM and FEMA personnel, affected citizens, and any other relevant entity. This information will be provided to the County Emergency Government and Communications Committee for their review.

At a duly called and posted public meeting, the County Emergency Government and Communications Committee will consider factors which contributed to any impacts of the hazard event, the likelihood of the event reoccurring, and any strategies which should be implemented to mitigate the impacts in the event of a reoccurrence. The Emergency Management Coordinator will have primary responsibility for establishing post-disaster review meeting dates, distributing related materials, and facilitating the meetings. The Emergency Management Coordinator will also advertise these special meetings to affected department heads, citizens, or community groups, so additional input and comment can be received. Special post-disaster review meetings will be subject to the Wisconsin Open Meeting Law and properly noticed to allow for public involvement and comment.

The County Emergency Government and Communications Committee may select to revise or amend the existing Plan. As appropriate, recommended changes to the Plan will be forwarded to the County Board and the Emergency Planning Committees of the participating incorporated municipalities for their action and consideration. New or additional mitigation strategies may not require plan amendment, though should be incorporated within the Plan if grant funding is being pursued.

iii. Plan Updates

Every five years, the Hazards Mitigation Plan will be comprehensively reviewed, current data collected, and fully updated. The next full Plan update will be completed and adopted no later than December 18, 2012. This planning effort should be robust and incorporate opportunities for public involvement to meet all requirements of 44 CFR Part 201.6 and/or any applicable requirements or regulations developed in the interim.

At that time, the Emergency Management Coordinator will propose a plan update steering committee and process for County Board approval, and will include representation on behalf of participating jurisdictions. Plan update steering committee meetings will be subject to the Wisconsin Open Meeting Law and properly noticed to allow for public involvement and comment.

C. PLAN ADOPTION

On December 18, 2007, the St. Croix County Board considered and adopted this Plan in a duly posted and held public meeting. This approval process is described in detail in **Section I.B.** at the beginning of this Plan.

Since this is a multi-jurisdictional plan, the following incorporated municipalities in St. Croix County also adopted the Plan via resolution:

Jurisdiction	*Adoption Date*
St. Croix County (encompasses all unincorporated areas)	12/18/07
Village of Baldwin	04/09/08
Village of Deer Park	03/03/08
Village of Hammond	04/15/08
Village of North Hudson	03/25/08
Village of Roberts	04/14/08
Village of Somerset	02/26/08
Village of Star Prairie	03/05/08
Village of Wilson	04/08/08
Village of Woodville	03/11/08
City of Glenwood City	06/02/08
City of Hudson	04/07/08
City of New Richmond	03/10/08

A copy of the adopting resolutions from all participating municipalities are included in **Appendix A**.

As discussed previously, the Village of Spring Valley and City of River Falls have adopted the *Pierce County All Hazards Mitigation Plan* since these communities largely lie within Pierce County and only a portion of these municipalities are located in St. Croix County. Though both of these communities were interviewed during the St. Croix County planning process, they did not adopt this plan. Hazard issues and strategies pertaining to the Village of Spring Valley and City of River Falls are identified and discussed in the Pierce County plan.